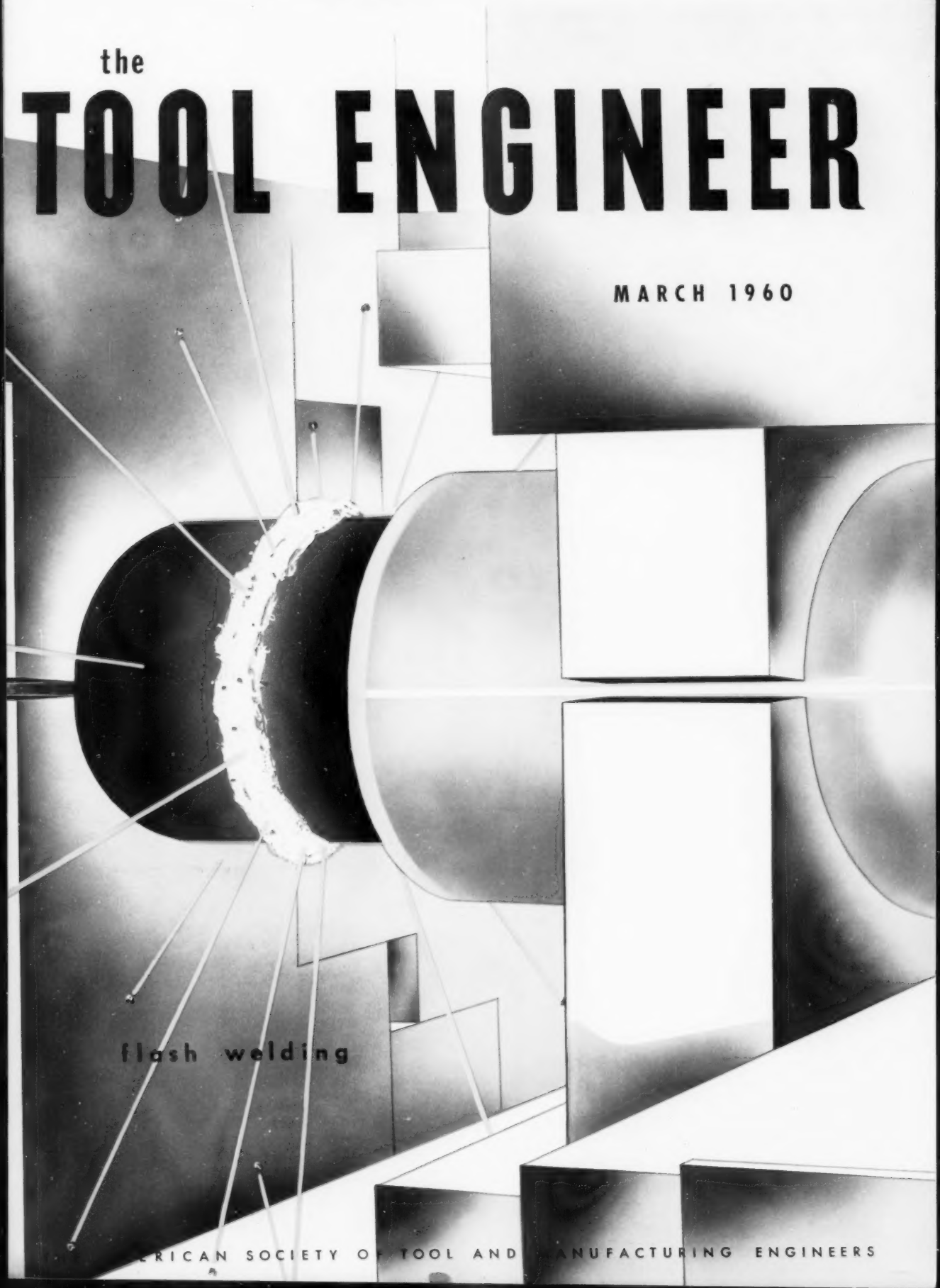
the

TOOL ENGINEER

MARCH 1960



flash welding

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

where so much depends on so little

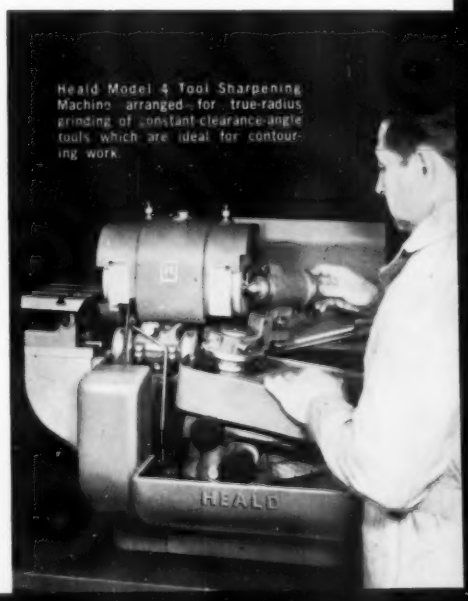
when the tool tip contacts the work

The modern automated production line is a miracle of cost-saving efficiency. But all its ingenious complexity has but one purpose—to bring work and tooling together. *That's* the point where it either pays off or it doesn't.

To assure maximum productivity—hence maximum return on the investment—cutting tools must be sharpened with machine precision. When they are ground on a Heald Model 4 Tool Sharpening Machine, *exact tool geometry* is obtained every time—and cutting edges *last longer*, saving down-time for tool replacement.

This advanced design machine is available for both true-radius and conventional elliptical-point tool grinding. Its fully automatic tool reciprocation assures uniform and repetitive tool tip accuracy and permits one operator to tend several machines at the same time.

Ask your Heald engineer for complete information on the Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3, Issue 1.



Heald Model 4 Tool Sharpening Machine arranged for true-radius grinding of constant-clearance-angle tools which are ideal for contouring work.

HEALD

It PAYS to come to Heald

MMT-PE

THE **HEALD** MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • London • New York • Philadelphia • Syracuse

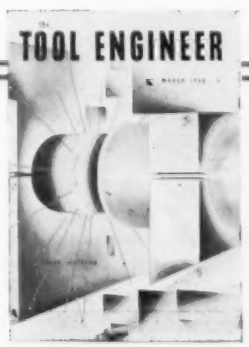
the tool engineer

Vol. 44, No. 3
March 1960

Creative Manufacturing is TOOL ENGINEERING

THIS MONTH'S COVER

Threaded tool joints are joined to 30-foot lengths of oil drilling pipe by flash welding. The pipe and joint are heated, then forced together under high pressure. The resulting joint is so reliable that none has ever failed in service. Details of the welding operation are given in the article starting on page 89.



THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*. The magazine is available to libraries and other institutions in microfilm form.

Harry E. Conrad
Executive Secretary

Editorial Staff

John W. Greve
Editor
Theodore W. Black
Senior Associate Editor
J. Frederick Parr
Associate Editor
Robert Heslen
Associate Editor
Daniel B. Dallas
Assistant Editor
Eleanore Vinall
Assistant Editor
Patricia Libel
Editorial Assistant
M. L. Stone
News Editor
Elizabeth R. Rooney
Assistant News Editor
Michael Babala
Art Editor
Henry Werner
Assistant Art Editor
Joan Crampton
Editorial Assistant

Business Staff

Michael Jakesy
Business Manager
Austin G. Cragg
Director of Sales
Peter A. Toma
Production Manager
Marjorie A. Hunt
Circulation Manager

Regional Advertising Managers

Francis Baldwin
New York
Donald N. McElwain
West Hartford
John G. Clarke
New Bedford, Mass.
George J. Zavis
Cleveland
Alan Cobleigh
Detroit
Stanley F. Girard
Chicago
Gus Krimsier
Atlanta
Robert E. Ahrensdorf
Los Angeles

Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Regional Advertising Offices
Address and telephone numbers are listed in "Index of Advertisers" in this issue.

Publication Office
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly, except semimonthly in June, in the interest of members of the American Society of Tool and Manufacturing Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the act of March 3, 1879. Yearly subscriptions: members, $5.00, nonmembers, $8.00; Canada, $6.50, and all other countries, $4.00.

Watch Tool Design Costs

Tool engineering departments plan for and install the latest and most economical production equipment. When a better method is developed they are quick to see its advantages and adapt it to production without delay. That is part and parcel of a day's work.

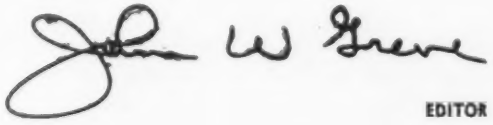
Many of these departments, efficient in the manufacturing phases, are careless and inefficient in organizing and operating the engineering department. This is particularly true in the drafting room. It is not unusual to see unnecessary and time-consuming methods still in use. They are costly and wasteful of engineering talent.

Frills add little or nothing useful on a drawing. Modern simplified methods and techniques for drawing are adequate. They save time and accomplish the purpose of a drawing, giving information that is clear and concise. There is no need for fancy shading. In fact, freehand sketches should suffice in many instances where nice finished drawings are now used. Engineering school drafting courses include freehand sketching, but this seems to be the end of it.

Many aids are available. Preprinted tracing paper with borders, boxes and standard data for groups of drawings save considerable time. Also, photographic methods provide useful duplicates for standard parts of drawings in a series of designs using the same components.

Tool design is a cost. An awareness should be developed to include it as part of over-all production costs. Use of the lowest skills that are required to do the job properly is an accepted axiom in the shop. It should also be so in the tool design room. Detail work is still too often done by the skilled tool designer.

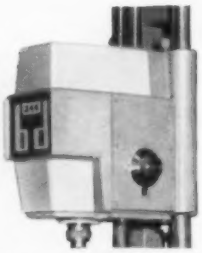
Time is money in the tool design room too!



EDITOR

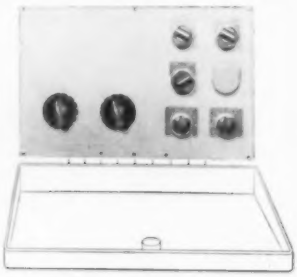
Here's Why Accurate Honing Is Easier On The New BarnesdriL Model 244...

Hone Feed — simple dial gives infinite adjustment.

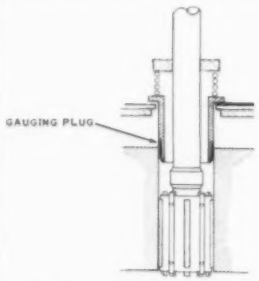


4-Speeds — turn of knob selects desired speed rate.

Reciprocation — length of stroke selected by convenient dial.

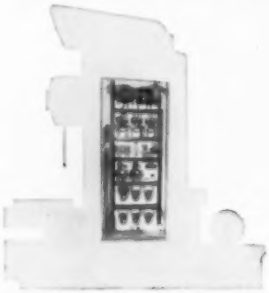


Set-Up — controls under lock and key.

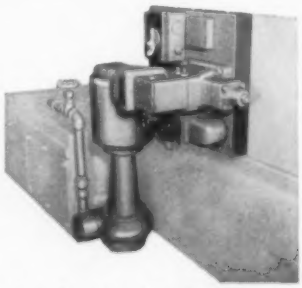


Plugmatic — automatic sizing assures accuracy within .0002".

Operating Controls — mounted at shoulder height.



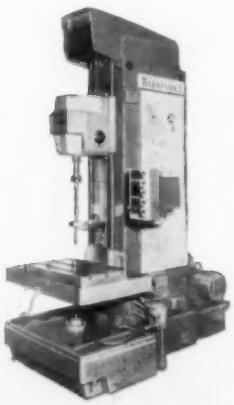
All Electric Controls — enclosed inside machine column.



Coolant Pump and Hydraulic Valves — easily accessible.

Hydraulic Pump — in open, for easy maintenance.

BarnesdriL offers a completely new honing machine for high production honing of bores ½" to 6" in diameter. Large diameter applications depend upon amount of stock removal, bore length, and material. Machine is available with one or two spindles and a choice of three stroke lengths: 15", 25", or 40". For complete details see your BarnesdriL representative or write for new bulletin H-112 today!



BARNESDRIL HONING MACHINES

BARNES DRILL CO.

670 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

HARDINGE
ELMIRA, N.Y.

HARDINGE Sjogren Chucks

Quality at Low Cost

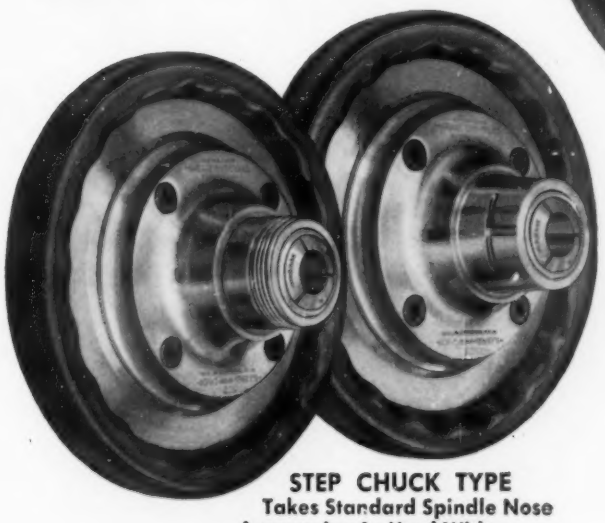
HARDINGE-SJOGREN Speed Collet Chucks for tool room lathes, engine lathes and grinders.

Available for Threaded Nose, Cam Lock, Taper Key Drive and American Standard Spindles.

REGULAR TYPE

AVAILABLE IN FIVE COLLET CAPACITY SIZES

1 1/16", 1 3/8", 1 3/4", 2 1/4", 3 1/2"



STEP CHUCK TYPE
Takes Standard Spindle Nose Accessories As Used With Hardinge Precision Machines

LEVER TYPE

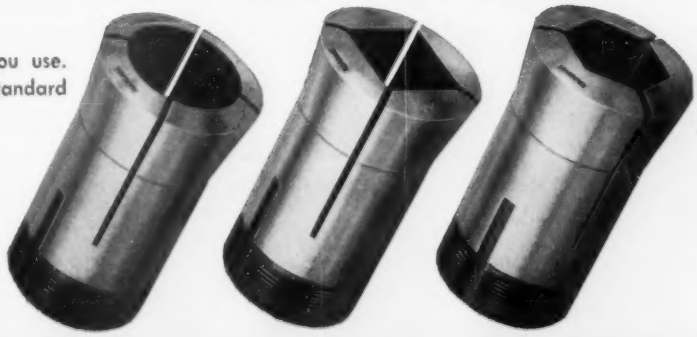
Ask Your Hardinge Representative or Local Distributor For Bulletin 88

HARDINGE
ELMIRA, N.Y.

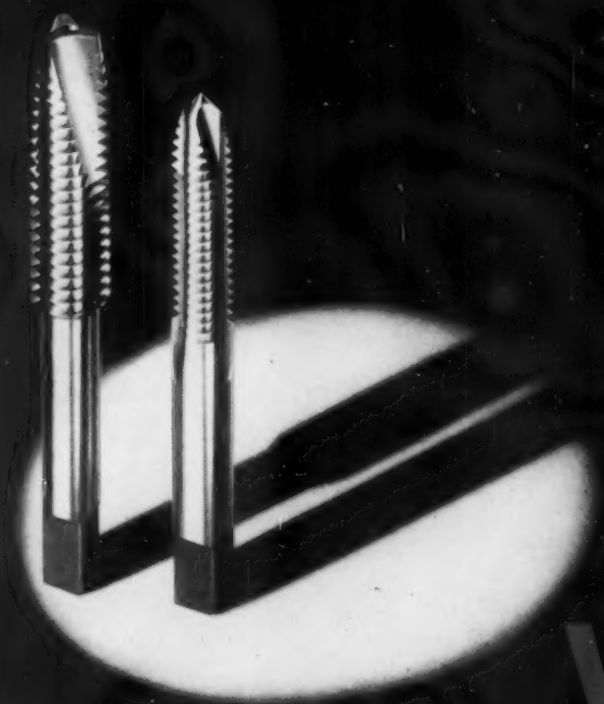
HARDINGE Low Cost Steel Collets

Maximum efficiency — Pay for only what you use. Records show that 82% of all sizes used are standard 16th sizes.

But only the sizes you use — Hardinge Collet stocks are available in Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, Minneapolis, New York, Oakland, Philadelphia, Portland, Rochester, St. Louis, Seattle. Also, Montreal and Toronto, Canada.



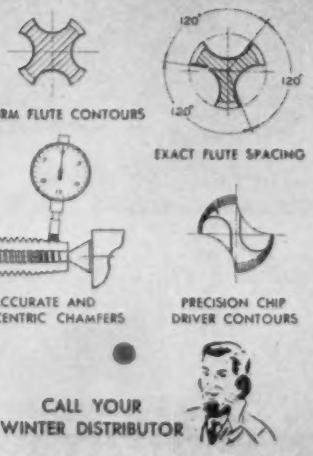
HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.



spiral pointed taps by

WINTER

WITH BALANCED ACTION



CALL YOUR WINTER DISTRIBUTOR

Winter Spiral Pointed Taps are recommended for almost every type of through-hole tapping. Short Flute Spiral Pointed Taps provide increased strength and rigidity for tapping thinner sections in soft, stringy materials.

Exclusive Balanced Action is built into every Winter Tap by painstaking attention to manufacturing detail. This inherent 'plus-value' is your guarantee of top performance from Winter Spiral Pointed Taps, as well as lower cost-per-hole.

Specify Winter Brothers Balanced Action Taps . . . the best tools available for every tapping job, every material.

WINTER BROTHERS COMPANY

ROCHESTER, MICHIGAN, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles

CHOOSE FROM WINTER'S WIDE LINE OF TAPS, DIES AND GAGES

National

tools plus...

self-thinned
heavy duty
*drills**

The engineering staff at National is constantly alert to the needs of industry for tools that save time, lower costs. Patented self-thinned heavy duty drills are a specific example of this conscientious research program. Thinning operations have been built right into flute contours to save time when resharpening and maintain contour accuracy throughout the long, usable life of the drill.

Self-thinning heavy duty drills are available in a wide range of stock sizes at established list prices from your National Distributor.

For lower metal-cutting costs, specify National, the tools plus!

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A.

TWIST DRILLS • REAMERS
COUNTERBORES • END MILLS
MILLING CUTTERS • HOBS
CARBIDE AND SPECIAL TOOLS

CALL YOUR
NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL & TOOL COMPANY

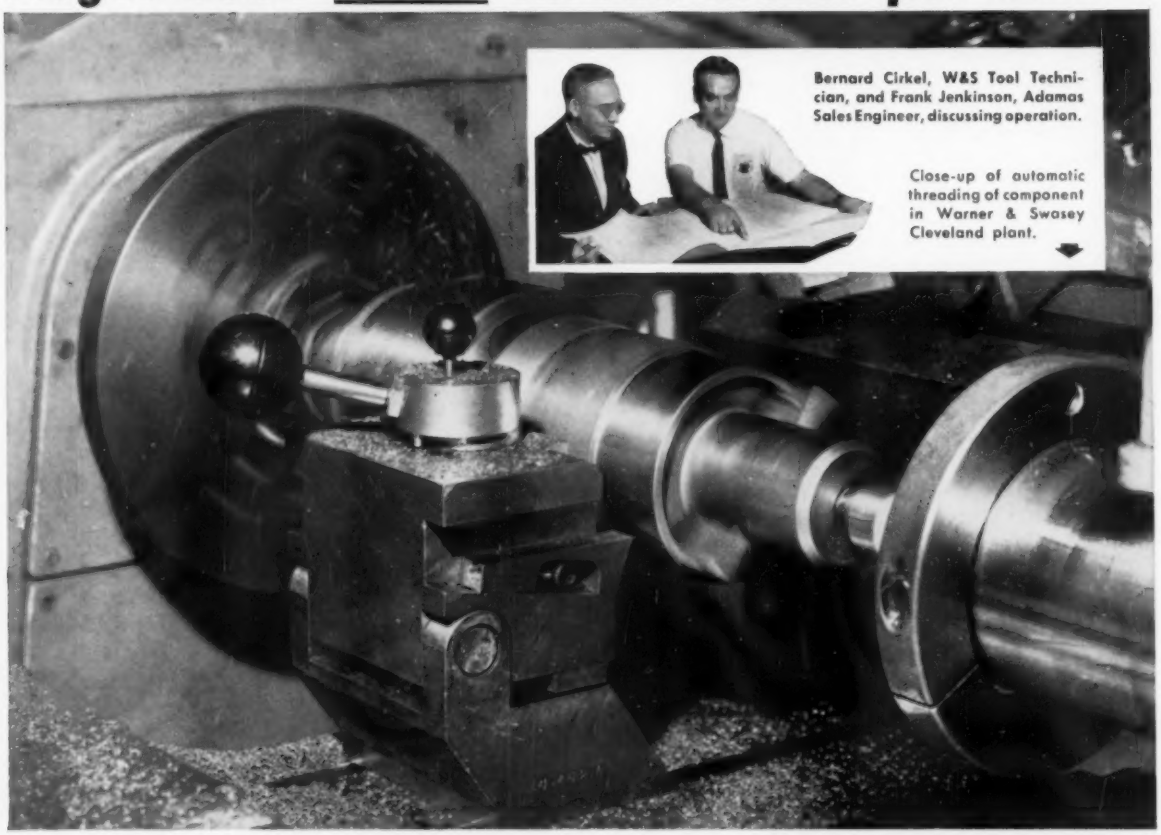
ROCHESTER, MICHIGAN, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles

* JUST ONE OF NATIONAL'S PARADE OF PLUS PRODUCTS

ADAMAS CARBIDE HELPS WARNER & SWASEY CUT COSTS

...get 8000 MORE thread inches per insert



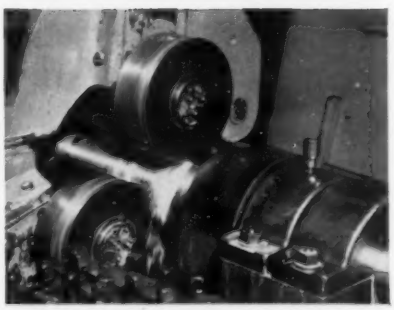
Bernard Cirkel, W&S Tool Technician, and Frank Jenkinson, Adamas Sales Engineer, discussing operation.

Close-up of automatic threading of component in Warner & Swasey Cleveland plant.

■ Warner & Swasey has chosen Adamas Grade CC throwaway inserts to cut threads on components such as spindles and shafts. Until recently they produced 10,000 inches of thread per insert. After setting up their tools with triangular Adamas Grade CC throwaways (TB12P20), their output increased to 18,000 inches per insert.

On SAE 1050 and SAE 4140 steel stock 2" to 6" OD, at 450 and 500 sfpm, W&S cuts 12 and 16 pitch std threads 1" to 4" long. The operation is a completely automatic cycle—15 passes (approximately .0035" depth per pass) per thread.

Cost-saving performances are typical of Adamas products . . . for complete information or on-the-job assistance, write: Dept. 311.



In another Adamas application at W&S, Grade 548 is used in trepanning spindle holes.

Producers of
Tungsten Carbide Tools,
Tool Tips,
Dies, Wear Parts,
Dex-A-Tool

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

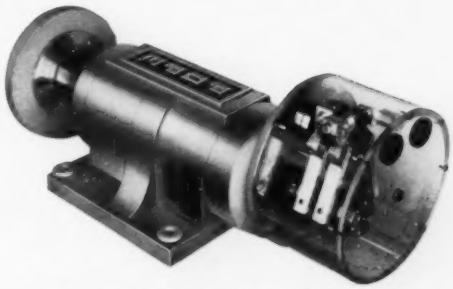
PROGRESSIVE TOOL ENGINEERS SELECT BY *Performance* — NOT HABIT!

For Fast Removal Of Tough Metals
Specify ELECTROLYTIC GRINDING

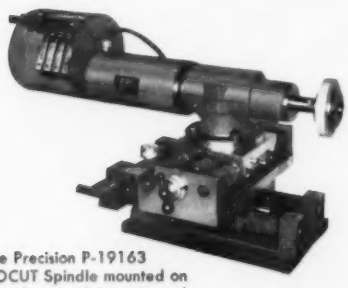
For Electrolytic Grinding
Specify POPE PRECISION "ANOCUT" SPINDLES
with total eccentricity of shaft less than fifty millionths (.000050")

Pope "Anocut" Spindles are available for 50 to 3000 amp. operation, motorized or belt driven with wheels up to 28" dia. They are equipped with built-in insulation and a *new* Pope rugged fork type, cool operating brush assembly for transmitting low voltage, high amperage current to the wheel.

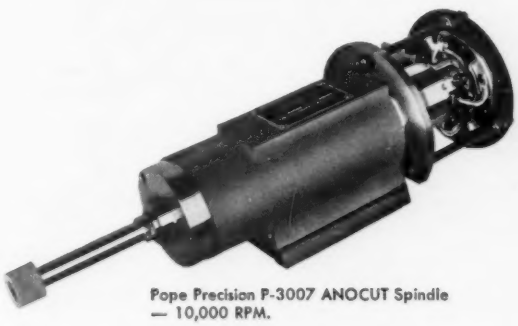
To get the most production out of electrolytic grinding, you need Pope designed, precision built electrolytic grinding spindles. Let us have your specifications for quotations.



Pope Precision P-19162 ANOCUT Spindle; 1 to 20 HP, 1800 RPM.



Pope Precision P-19163 ANOCUT Spindle mounted on Pope heavy duty universal slide with indicators for measuring feed in ten-thousandths.



Pope Precision P-3007 ANOCUT Spindle — 10,000 RPM.

Pope Precision P-6651-XG-S4 ANOCUT Tilting Head for attaching to Cincinnati #2 Tool and Cutter Grinder.

Pope Precision P-12001 ANOCUT Spindle — for 2000, 3000 and 5000 RPM.

No. 127

POPE®

ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

Six-Cylinder Engines Now Processed on Cross Transfer-matics That Made V-8's a Few Months Ago

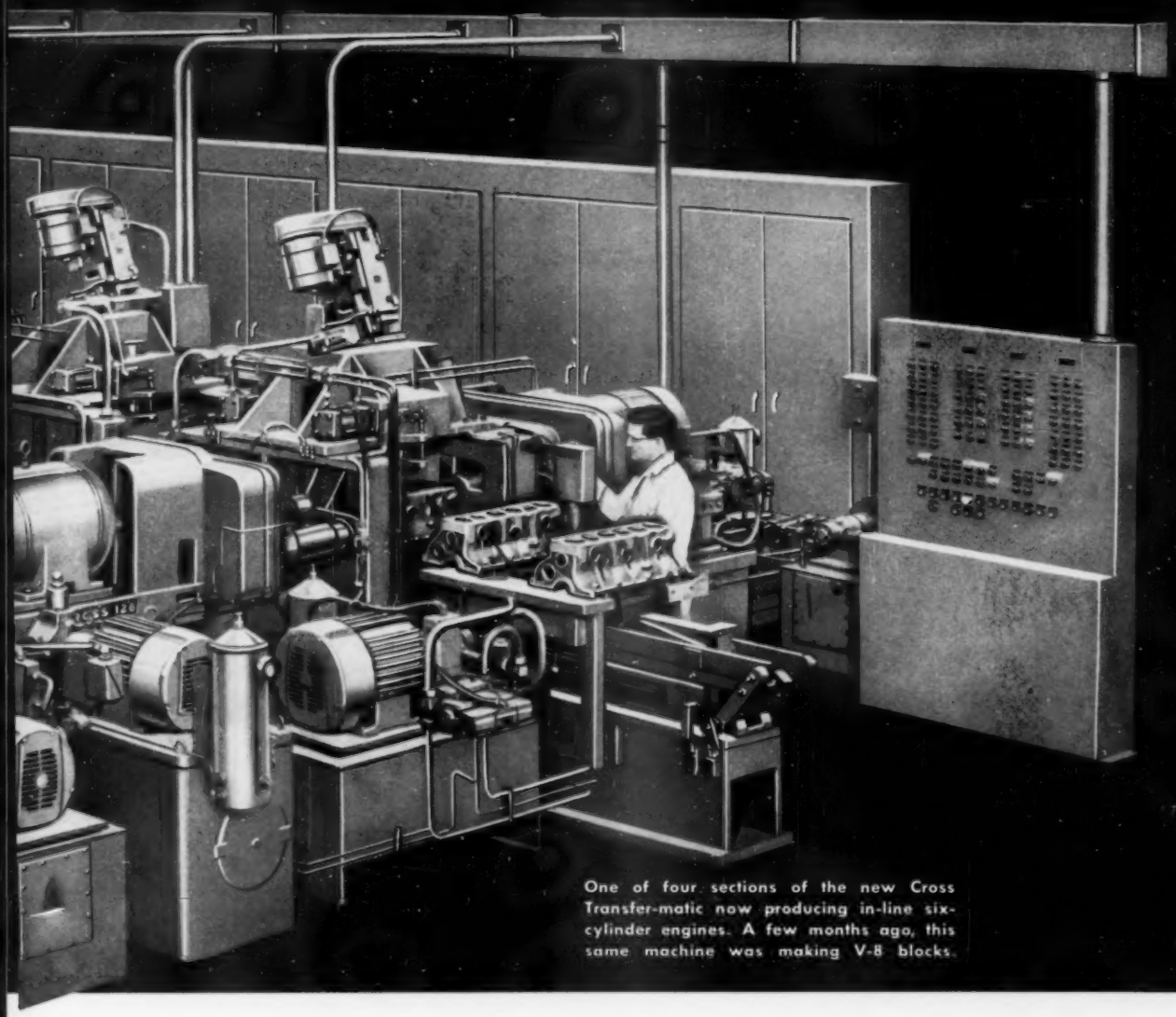
PART: In-line six-cylinder block.
OUTPUT: 100 per hour at 100%
OPERATIONS: Milling, drilling, boring, reaming and tapping.

Cross "Building Block" Construction Permits Reworking Line at 40% of Original Cost

A few years ago Cross delivered, to a large automobile manufacturer, three Sectionized Transfer-matics for machining cylinder blocks for high powered V-8 engines. These machines introduced new concepts of flexibility by standardizing bases, transfer mechanisms, fixtures, heads and other component parts.

Last year, due to public demand, the car company had to make a quick switch from V-8 engines

Another Transfer-matic by Cross



One of four sections of the new Cross Transfer-matic now producing in-line six-cylinder engines. A few months ago, this same machine was making V-8 blocks.

to small in-line sixes. The new standards that Cross created for these Transfer-matics permitted the change to be made in a minimum amount of lead time and at a cost savings of 60%.

Today, one line is already producing in-line six-cylinder engine blocks and a second line is being converted for a production increase during 1960. This is proof positive that Cross engineered flexibility does pay off and that it costs no more.

Established 1898

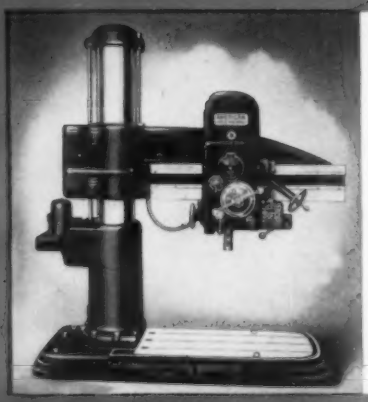
THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Use Reader Service Card, CIRCLE 9

? Are you really putting your small radial drills to work...OR... are they just drilling machines



If they are "AMERICAN" Hole Wizards they are DRILLING...TAPPING and BORING MACHINES

...not just radial drills!

To further improve their boring qualities the new "AMERICAN" 9 inch and 11 inch column Hole Wizards now may be equipped with a FINE FEED BORING ATTACHMENT.

This attachment, furnished in addition to the standard feeding mechanism, merely by the flip of a lever reduces the standard feed range 75 per cent.

The fine boring feeds thus provided are the answer to precision boring on radial drills. Many tool and die shops are already using them for high precision, fine finish boring of jigs and fixtures.

And don't overlook the advantages of the Hole Wizard's Helical Gear—Lo-Hung Spindle Drive —NITRIDED SPINDLE AND SLEEVE—TIMKEN MOUNTED WITH OUTSIDE ADJUSTMENT FOR SPINDLE BEARINGS.

These exclusive "AMERICAN" features permit putting your radial drills to work at a profit.

- ***Ask for bulletin No. 325 and get all the facts.***

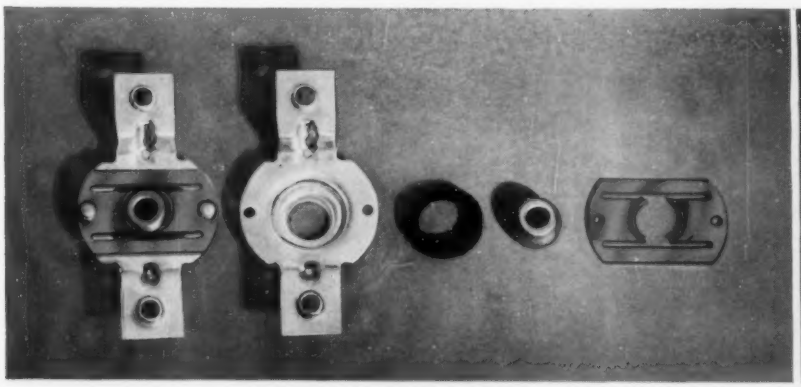
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

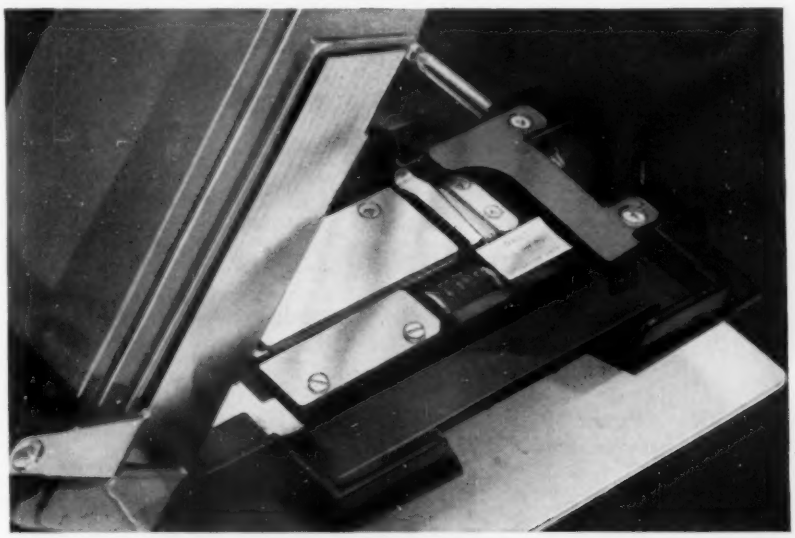
Use Reader Service Card, CIRCLE 10

NEW BRONZE
CAN CUT SPRING COSTS—

Superfine-grain phosphor bronze by Anaconda now handling many tough jobs, replacing costlier materials.



RETAINING CLIP for a bronze bearing in the Handy Hannah Hair Dryer was originally of spring steel. Rejections ran 20% in the stamping operation and another 20% at the assembly stage. The Handy Hannah Products Corp., Whitman, Mass., switched to Duraflex, Anaconda superfine-grain phosphor bronze, found it had not only the spring quality and fatigue resistance needed for the job—but also had superior formability which eliminated rejections.



SPRING CLIP takes a steady beating as it holds invoices in place in imprinting machines—used widely in handling charge accounts by retail stores and service stations. In the imprinter (right) made by the Farrington Mfg. Co., Needham Heights, Mass., this clip was originally of beryllium copper. Hearing about the superior fatigue life and endurance limit of Duraflex, Farrington consulted Anaconda technical specialists and decided to try it. Duraflex has been doing the job now for two years, stands up in service, saves $1.50 a pound in material cost.

TESTS by an independent laboratory show that design stresses for Duraflex wire and flat springs can be from 33% to 50% higher than for those made from regular phosphor bronze—yet Duraflex costs no more than regular phosphor bronze. Get the test reports and revaluate all your components requiring spring properties. For copies of these reports or technical help in selecting the right alloy and temper, see your Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 4048

DURAFLEX®

SUPERFINE-GRAIN PHOSPHOR BRONZE

A PRODUCT OF

ANACONDA®

Made by The American Brass Company

DIE SET DATA

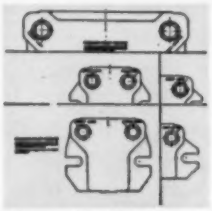
available from **PRODUCTO**

Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*

Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*

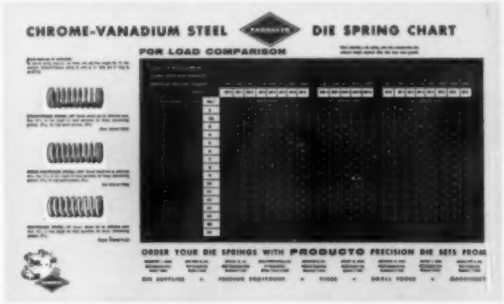


Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.

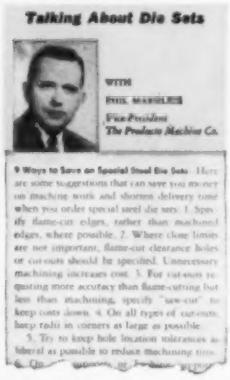
Die Set Specification Stamp

Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Die Spring Comparison Chart

Die spring selection is simplified by this 12″ x 20″ chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

*WRITE TODAY for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.

THE PRODUCTO MACHINE COMPANY
925 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

they turn in top performance to turn out top results

SIMONDS ABRASIVE SEGMENTS

for

- increased production
- excellent finish
- superior surface grinding

GAP TYPE

SOLID TYPE

All segment sizes and shapes available for both gap type and solid type segmental wheels.

No matter how you measure performance . . . faster production, better finish or longer life . . . Simonds segments fill the bill, and more. Why? Because, by determining exactly the grain and grade specifications for your jobs, Simonds representatives equip you with segments designed for the kind of top performance *you* want. Carefully manufactured for dimensional accuracy, uniform grinding action and consistent performance from lot to lot. All sizes and shapes for all chucks. Order from your Simonds distributor.

Write for bulletin ESA 188

SIMONDS ABRASIVE CO.

Tacony & Fraley Sts.
PHILADELPHIA 37, PENNA.
Division of Simonds Saw and Steel Co.

COUNT ON / YOUR SIMONDS DISTRIBUTOR
FAST SERVICE • LOCAL STOCKS

WEST COAST PLANT: EL MONTE, CALIF.—BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO
SHREVEPORT—IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

"The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

Here's why Lufkin's indicator is the most sensitive!"

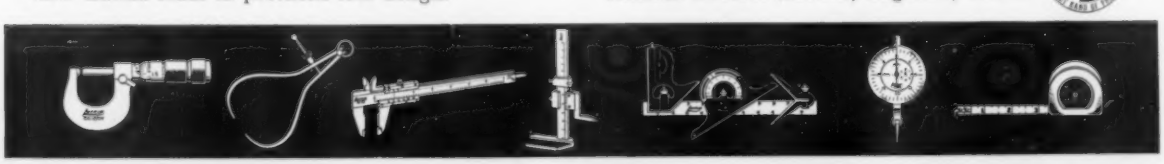
It is made with the precision of a fine watch, with jeweled bearings for longer life.

Lufkin's V32 Dial Test Indicator has a 180° contact point swivel. The dial has clear, easy-to-read graduations to .0001". . . and a switch lever for full reverse action.

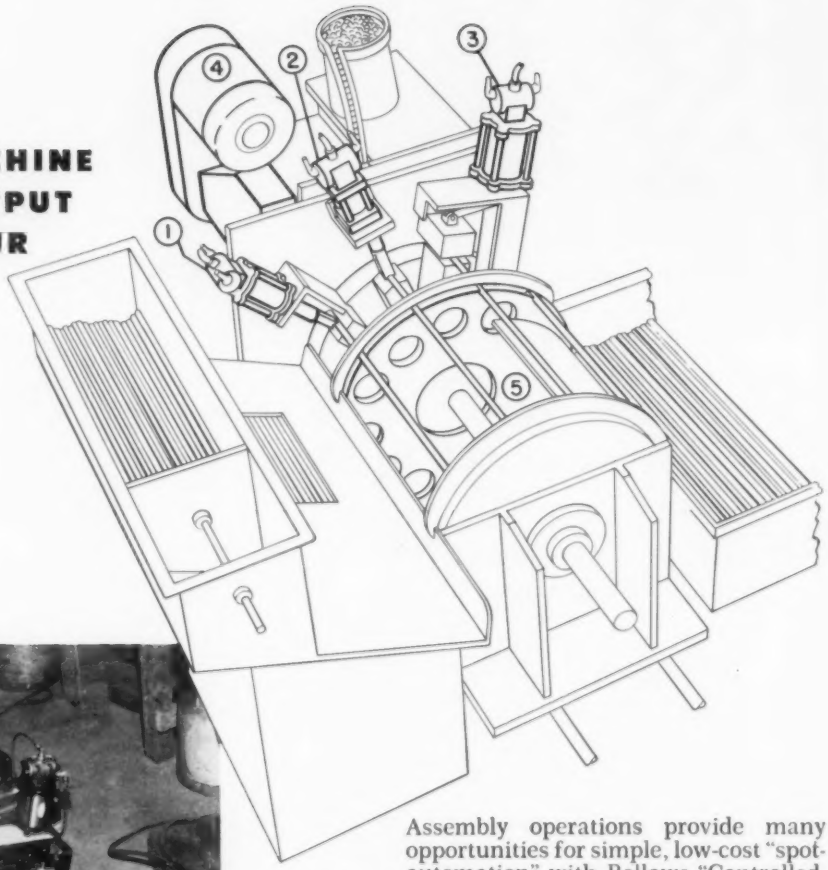
Exclusive ball-bearing mounting reduces friction, assures greater accuracy—an excellent example of how Lufkin leads in precision-tool design.

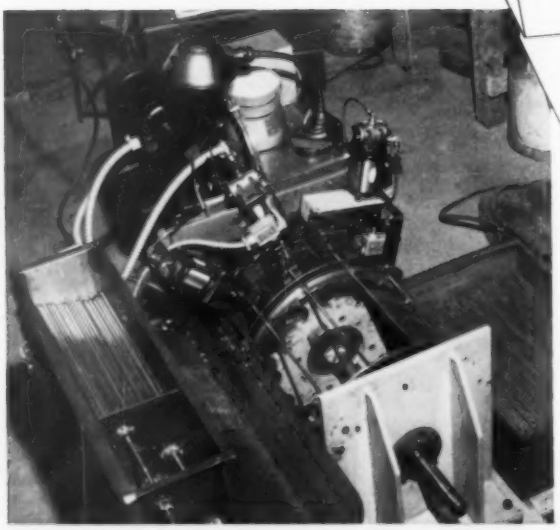
Mount the V32 on a Lufkin Miti-Mite Holder with its rigid (5/16") center post and you have a vertical testing setup that will stay firmly in place. (There's a permanent magnet in the base with a 50-lb. pull.)

See your industrial distributor. He knows precision tools and can show you how Lufkin leads in design and craftsmanship. His stock is maintained to fit your needs. See him for prompt and reliable service. LUFKIN, Saginaw, Mich.



THIS SHOP-BUILT MACHINE INCREASED OUTPUT PER MAN-HOUR 500%





Incorporating five Bellows Air Motors (#1, #2, #3, plus two others, horizontally-mounted, not visible) and a Bellows Drill Unit (#4), all electrically interlocked with the vertically-mounted Bellows Rotary Table (#5) which feeds the workpieces through the various operations, this machine counterbores one end of a .300" brass tube, inserts a small plastic seal, curls the end of the tube to retain the seal and delivers the completed antenna sub-assembly into a hopper ready for plating.

Assembly operations provide many opportunities for simple, low-cost "spot-automation" with Bellows "Controlled-Air-Power" Devices. Costs go down immediately as these versatile work units boost the productivity of each worker.

A case in point is this machine, built entirely around Bellows "Controlled-Air-Power" Devices, which performs an assembly sequence in the manufacture of automobile antennas. Designed by the Plant Superintendent working with a Bellows Field Engineer, the unit requires only one operator (who merely loads and unloads hoppers), yet produces the same number of pieces as five assemblers working manually.

This machine is typical of the ways that cost-conscious men are using Bellows "Controlled-Air-Power" Devices — either singly or in combinations — to perform a virtually-unlimited range of operations. It's almost a certainty that Bellows units can help you meet — *or exceed* — cost reduction goals in *your* plant, too.

THIS SPOT-A-MATION IDEA FILE IS YOURS ON REQUEST

Contains installation data, wiring diagrams and equipment lists for numerous Bellows "Controlled-Air-Power" applications, enabling you to automate existing machines or build your own low-cost special-purpose equipment. Write for yours today. Address Dept. TE-360, The Bellows Co., Akron 9, Ohio.

640-C

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

AKRON 9, OHIO

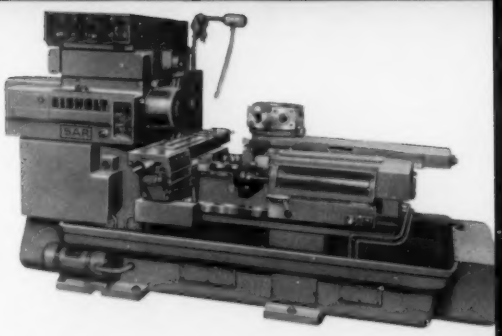
OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

PRODUCTION POINTERS from GISHOLT

MASTERLINE GISHOLT SINCE 1887

NEW GISHOLT AR LATHE SAVES GRAY COMPANY 50% ON BAR AND CHUCKING JOBS

New No. 5AR (Automatic Ram) speeds machining, improves quality, lengthens tool life on job lots and production runs



"Why buy two when one will do?" That was the basic reasoning used by Gray Company, Inc., Minneapolis, Minnesota, in selecting an automatic to replace hand-operated machines for bar and chucking work. This firm found the ideal answer in the new Gisholt AR—*the first truly automatic ram type turret lathe.*

The new No. 5AR turns out parts 50% faster, on the average, than manually operated turret lathes. Operator fatigue is eliminated with the automatic cycle. Tool life is longer; work quality and production rates are consistent; tolerances are easily held.

Gray Company manufactures the well-known "GRACO" line of air-powered pumps for transfer and application of materials, and automotive servicing equipment. Here is how a typical job, a cast iron reel hub, is handled on the new 5AR. The work is machined in two operations. Only the second operation is illustrated. The operator chucks on the O.D., locating against the previously machined face. Multiple tooling on the hex turret drills, shave-faces, turns the O.D. and the pilot diameter. Tooling on the second station finish-bores. The cycle stops at station 3, which is blank, providing ample space for loading and unloading. Front and rear cross-slide tools operate at separate times with the two turret stations to step-face the work. The turret is double-tooled to finish two pieces with each complete index. Finish ranges from 100 to 125 micro-inches RMS. A tolerance of +.000", −.001" is held in the bore.

Compare these production rates

Operation 1

Manual turret lathe	14 pcs./hr.
New AR turret lathe	26 pcs./hr.

Operation 2

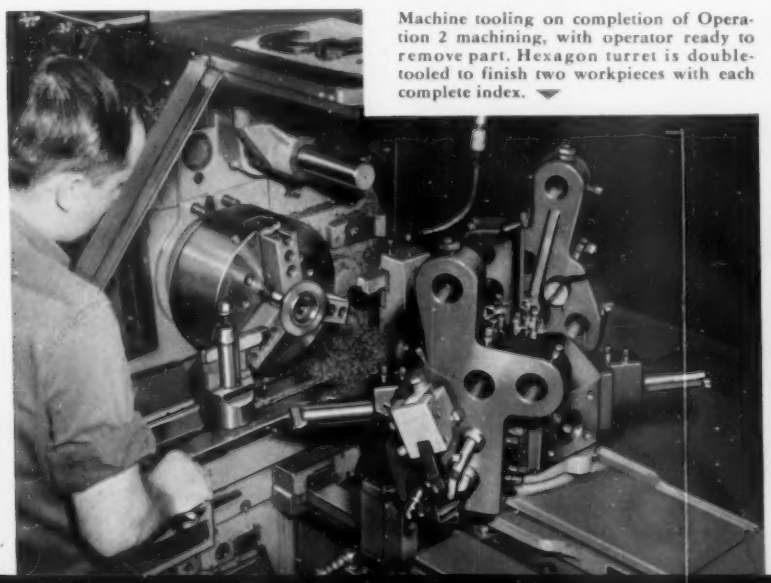
Manual turret lathe	34 pcs./hr.
New AR turret lathe	55 pcs./hr.

The new Gisholt AR Turret Lathe combines automatic cycle efficiency with the versatility and quick setup of the hand-operated ram type turret lathe. The automatic cycle frees the operator to handle another machine or do other work, in most cases greatly increasing productivity.

The Gisholt AR converts from chucking to bar work in approximately one hour. Aside from cycle programming, there are no new machine setup procedures to learn and no gears to change. It uses standard tools, available in most shops.

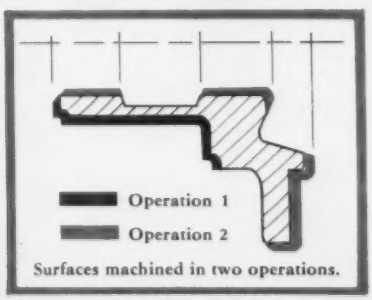
It sets up fast. Machine functions, electrically or hydraulically controlled, are preselected for each turret station. This includes spindle speeds, indexing, traverse and feed of the turret, and independent operation of the cross slide. An experienced operator learns to set up his own cycles in approximately one day.

To get the complete story on the versatility and economy of the AR—the new automatic ram costing little more than hand-operated machines—contact Gisholt.



Machine tooling on completion of Operation 2 machining, with operator ready to remove part. Hexagon turret is double-tooled to finish two workpieces with each complete index.

Left—rough workpiece; center—after first operation; right—after Operation 2.



Surfaces machined in two operations.

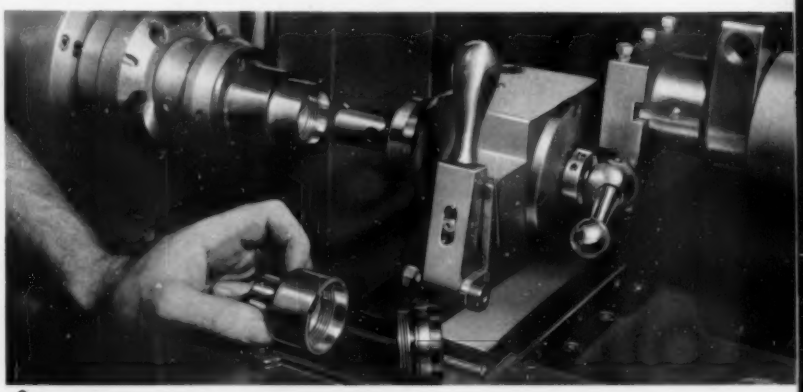
For complete information on new Gisholt AR, circle No. 708 on Reader Service Card.

CRI-DAN THREADS COMPLEX PARTS 100% FASTER FOR BELL AND HOWELL

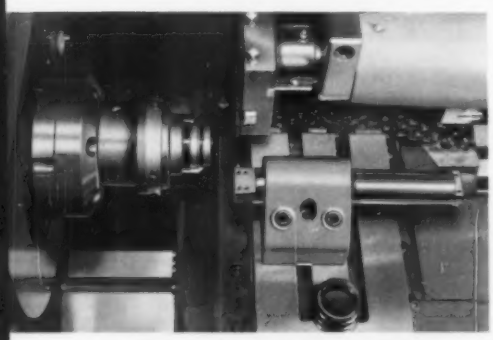
Two-start Class 4 threads and 32 micro-inch RMS finish produced by simple tooling setup

Looking for ways to reduce costs and improve quality on threading jobs? These CRI-DAN B setups for multiple-start threading to close tolerances may provide new answers. They cut threading time in half on two complex parts for Bell and Howell, Chicago.

The workpiece: a front cell lens with mating zoom operation sleeve for Bell and Howell 8 mm. Zoomatic movie cameras. Both require a 2-start, .0625-pitch, .125"-lead, Class 4 thread. In addition to a 32 micro-inch RMS finish, the lens diameter and the sleeve bore are held within ±.001" to assure smooth operation.



Zoom operating sleeve. Material, aluminum—with machined relief at back of bore. I.D. pilot diameter is finish-bored. Boring bar is indexed to the threading tool. A 2-start, .0625-pitch, .125"-lead, Class 4 16 NS thread in the 1.610" center section is produced in 12 automatic passes at 675 s.f.m. Threading time, 20 seconds.



Front cell lens. Material, aluminum. O.D. pilot diameter is turned. Single tool on front threading slide produces 2-start, .0625-pitch, .125"-lead, Class 4 16 NS thread on the 1.610" leading diameter in 12 automatic passes at 675 s.f.m. Threading time, 20 seconds.

The illustrations and captions show how simple, low-cost attachments are used with the fast CRI-DAN automatic threading cycle to combine operations for greater accuracy and increased production efficiency.

Using inexpensive carbide tools, the CRI-DAN method is many times faster than thread grinding or thread milling...handles toughest jobs on hardest materials for less.

For complete information on CRI-DAN, circle No. 709 on Reader Service Card

HERE'S ONE WAY TO REDUCE HANDLING AND SPEED CHUCKING OF HEAVY PARTS

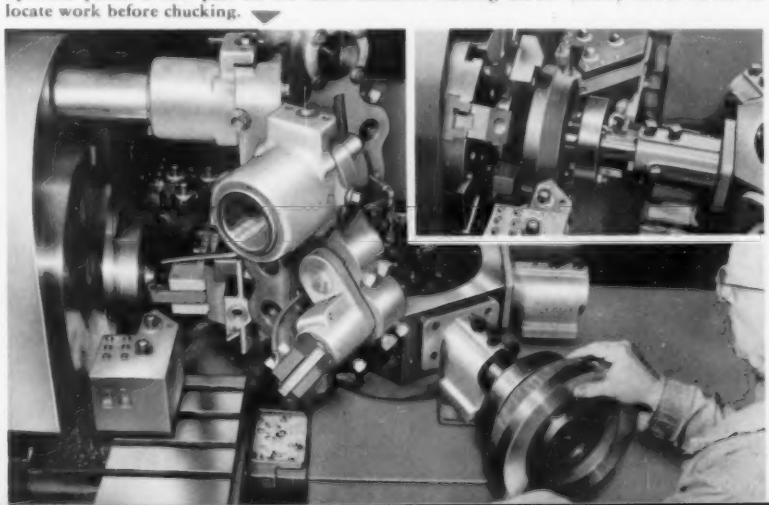
Turret-mounted loading arbor operates during automatic cycle on 2F Fastermatic

Whenever you're handling heavy or unwieldy work, a little extra attention to loading equipment can pay important dividends. For example, this job: The workpiece, a steel bomb base plug forging, is machined in two operations on two Gisholt MASTERLINE 2F Fastermatic Automatic Chucking Turret Lathes. One operator handles both machines. The second operation setup is shown. It illustrates how most of the work-handling is done *during* the automatic cycle.

Hex turret tools turn the O.D. and chamfer. Operating separately, rear cross-slide tools rough-face the flange and plug base, and front cross-slide tools finish-face the flange, relieve the flange base, and chamfer. A turret-facing attachment on the rear cross slide actuates a turret-mounted slide tool, finish-facing the plug base.

While the slide tool finish-faces, the operator places a new part on the turret-mounted loading arbor. The cycle ends with the rough part facing the spindle. The operator removes the finished piece and starts the new cycle. The hex turret brings the work to the chuck. Spring-loaded jacks force it against the chuck while it is gripped on the O.D. The hex turret reverse-traverses as the spindle rotates and indexes to the first machining station. Time, 7.2 min. f.t.f.

Tooling for second operation on bomb base plug. Turret-facing attachment on rear cross slide actuates turret-mounted slide tool, finish-facing the plug base. At the same time, the operator places a new part on the turret-mounted loading arbor. (Inset) Arbor about to locate work before chucking.



Loading arbor on hex turret operates as part of Fastermatic's automatic cycle—improving chucking accuracy, reducing handling time, increasing production.

For complete information on Fastermatic, circle No. 710 on Reader Service Card.

SUPERFINISHING SAVES TIME, ELIMINATES GRINDING ON PUMP SEAL FACE

Fixture on specially tooled Model 51 Superfinisher handles different part sizes

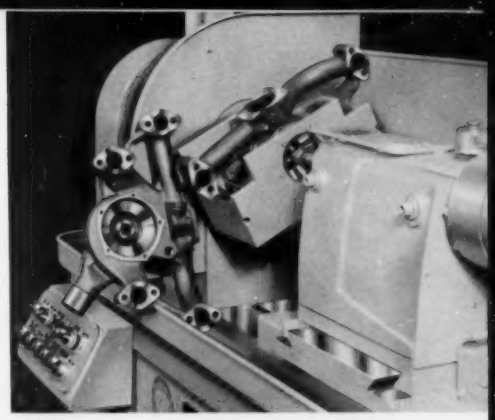
Here is a setup that cut finishing time 50% and eliminated grinding on the pump seal faces of cast iron water pump bodies for a well-known automotive manufacturer. This is a special job, demonstrating the versatility offered by the standard Gisholt Model 51 Superfinisher.

The machine consists of a standard bed with a special box-type fixture mounted on the spindle for centralizing, locating, holding and driving. The fixture is designed to handle more than nine different part styles. A self-driven rotary quill, carrying a cup stone, is also mounted on the bed. An air cylinder moves the quill into working position and retracts at cycle end for loading clearance. Guarding, not shown, encloses the headstock fixture and the rotary quill. It is mounted on tracks and moves easily for loading and unloading.

Here is the Superfinishing cycle: Work is placed in the fixture. The spindle and the cup stone rotate in opposite directions, reducing the pump seal face from a precision-machined surface of 100-125 micro-inches RMS to 8 micro-inches RMS. Superfinish stone contact time, only 12 seconds. Production rate, 60 parts per hour at 80% efficiency.

Specially tooled Model 51 Superfinisher handles unwieldy part in minimum time. Superfinishing eliminates intermediate grinding...provides "controlled" surface, free of smear metal, for longer service life.

For complete information on Gisholt Superfinishing, circle No. 711 on Reader Service Card.



Automotive water pump housing, held in special fixture on Model 51 Superfinisher. Seal face reduced from precision-machined surface of 100-125 micro-inches RMS to 8 micro-inches RMS in only 12 seconds stone contact time.

M & H VALVE & FITTINGS CO. COMBINES OPERATIONS, SAVES 40%

Two Gisholt lathes replace three machines, improve accuracy, simplify machining of fixture work

Right now in your shop you may have jobs where special tooling on a standard lathe can reduce complex work to simple routine operations. That was the case at M & H Valve & Fittings Company, Anniston, Alabama.

M & H came to Gisholt for recommendations for improving accuracy and production on tapered wedges and straight-faced flat discs. Three machines were in use. Wedges and discs were faced and grooved on one machine, a bronze ring was rolled-in on the second and faced on the third.

Gisholt suggested two new machines: a 1L and a 2L Saddle Type Turret Lathe which could be set up to complete a wedge or disc side in a single chucking.

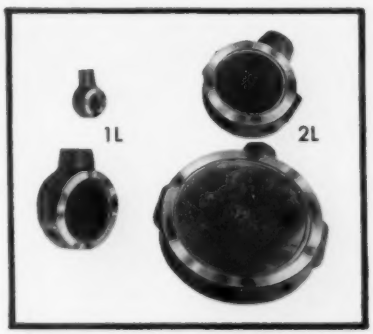
Two important machine features make such a setup possible: 1, machine flexibility combines special machine functions and tooling, and standard machining; 2, a cross-feeding hex turret eliminates need for cross-slide carriage, increasing the swing capacity of each machine.

A chucking fixture assures accurate parallel or angular relationships. Adjustable jacks hold straight work; tapered wedges are held in a special angular locating plate. The wedge is faced and grooved with special cross-feeding tool blocks. The brass ring is rolled-in with rollers mounted on a tool block. Force is applied by a special bed-mounted pusher bar. After rolling-in, the seat ring is finish-machined. One side of a typical 6″ tapered wedge is completed in just 9 min., f.t.f.

Change-over is fast, since tooling adjusts to accommodate all work sizes.

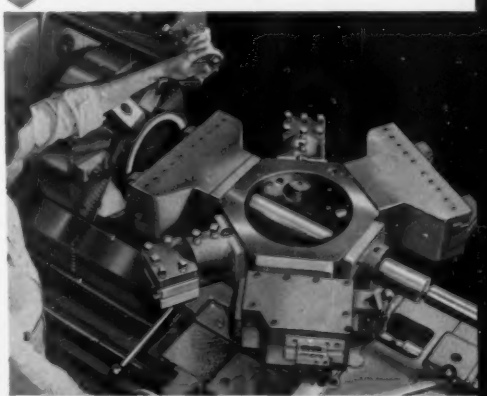
Two Gisholts replace three other lathes... eliminate two work handlings...improving accuracy. Time reduction averages 40%. Special tooling does not prevent use of machine for standard work.

For information on Saddle Type Turret Lathes, circle No. 712 on Reader Service Card



Workpiece range handled on two saddle type turret lathes. Seven sizes of tapered wedges and straight discs, from 2″ to 6″, are machined on the 1L. Four more sizes of each type, from 6″ to 12″, are machined on the 2L.

Overhead view of rolling-in operation on 12″ tapered wedge. Note thrust bar and tool block with rollers which seat brass ring. All tool holders adjust to part sizes.

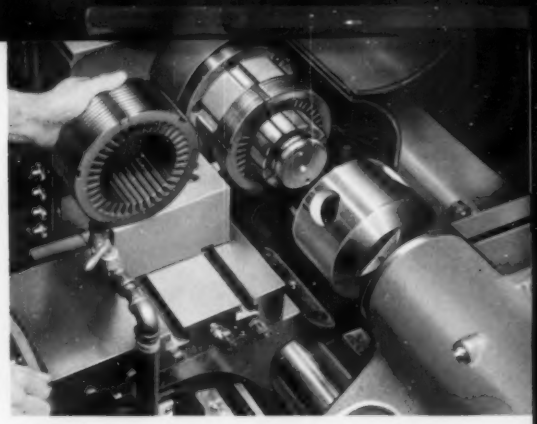


GISHOLT

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE

SMART SETUP SOLVES PROBLEM . . . CUTS TURNING TIME FOR WESTINGHOUSE

Simple tooling eliminates distortion on stator core assemblies...No. 12 Automatic speeds machining



Largest and smallest of five stack lengths of electric motor stator core assemblies. Cup-shaped tailstock prevents distortion. Simple spacer rings and mandrel bushings speed change-over to different sizes. No. 12 reduces turning time 25%.

You may never encounter a problem similar to this one faced by Westinghouse Electric Corporation, but you'll be interested in the solution. It points out that even the simplest job, on the *right* machine, can present problems that are solved only through experience—the kind of tooling know-how that Gisholt offers on all jobs, large or small.

The operation: Turning the O.D. on electric motor frame stator core assemblies. The machine: A Gisholt No. 12 Automatic Chucking Lathe.

Each core assembly consists of a number of free-cutting electric steel stampings, stacked and laminated. Five different stack lengths in each of two bore sizes are machined at high production rates.

Tooling appears simple. Work is held on an air-operated mandrel—is located against a spacer ring at the headstock end. Spacer rings compensate for different lengths, mandrel bushings for different diameters—keeping change-over at a minimum. A front carriage tool turns the O.D.

Here's the problem: It was found that the laminations at each end tended to "crimp" from tool pressure. Also, gripping in the I.D. caused the laminations at each end to "dish out."

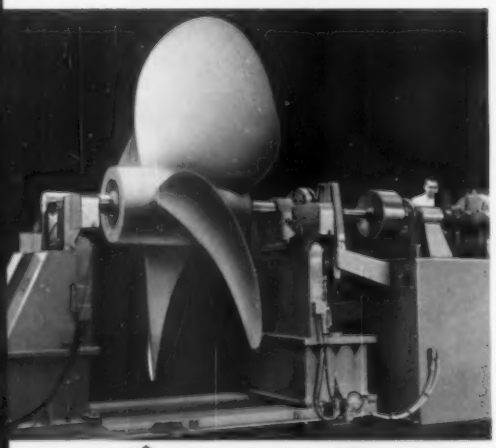
The solution: Maximum-diameter spacer rings eliminate distortion by providing support at the headstock end. A cup-shaped tailstock centering arrangement supports the mandrel and applies pressure evenly around the outer edge of the work.

Smart tooling eliminates work distortion... cuts change-over time on high-production parts. Fast, automatic cycle on No. 12 cuts time 25%.

For complete information on Gisholt No. 12 circle No. 713 on Reader Service Card.

BALANCES SHIP PROPELLER IN 83% LESS TIME

Gisholt Balancer saves 20 hours per propeller for Long Beach Naval Shipyard ...eliminates guesswork



This 12′, 15,650-pound destroyer propeller requires a single-plane, static unbalance correction—the method used when the diameter of workpiece is considerably greater than width. Machine is easily set up to measure and locate static unbalance, and check force or moment unbalance—keeping work well within tolerances required to eliminate excessive bearing wear and possible engine damage. Support pedestals adjust to accommodate work. F.t.f. times are reduced from 24 to only four hours average. Extreme accuracy offered by Gisholt Balancing reduces metal removal required to balance—extending propeller service life.

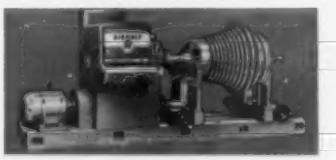
You may not have balancing jobs as large as this 12′-diameter ship propeller, but the balancing principles used here could give you greater speed and greater accuracy in your type of work.

Balancing time on former equipment averaged 24 hours for just one of these 15,650-pounders. In some cases, the job required two men working up to three 8-hour shifts. Considerable guesswork was required to meet the specified tolerances. This meant excessive trial-and-error grinding, with metal removal equaling five years of normal wear on some jobs. And the job was dangerous. Unbalance readings could be taken only at high speeds. There was always the chance that unbalance vibration would throw the huge propeller off the machine.

Now a Gisholt Type U Balancer, with electrical networks providing fast setup and accurate readings, has reduced average time to only four hours, f.t.f. This includes loading by crane, measuring and locating unbalance—correction by grinding, and inspection. Guesswork has been eliminated. Complete safety is assured: The work is held securely in half-bearings and rotational speeds have been reduced to a relatively slow 150 r.p.m.

Gisholt Balancer reduces big propeller job to routine operation with fast setup, accurate amount and angle readings... cuts average f.t.f. time 83%...reduces correction grinding...extends service life.

For complete information on Gisholt Balancers, circle No. 714 on Reader Service Card.



No. 3-460
756

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

AT BOOTH 427 ASTE SHOW, April 21-28 • DETROIT

the tool that adjusts precisely in seconds!

ELIMINATE "CUT AND TRY" WITH MICROBORE...

YES, EVERY TIME—ALL THE TIME! In seconds, with our proven micrometer vernier adjustment, any operator who can read a "mike" can adjust a Microbore Tool for precision boring to extremely close tolerances.

Any production man knows what that means. Elimination of wasteful down time. Greater productivity of men and machines. Fewer rejects. Better parts due to holding closer tolerances.

It just makes good sense to *Modernize with Microbore*. A few dollars so invested can increase the productivity of a machine costing thousands.

Microbore units can also be applied in clusters for special tooling designed for high production applications.

A wide range of Microbore Boring Bars with NMTB taper, Morse taper, Flash-Change and Straight Shanks are available singly or in complete sets. Standard set includes Microbore units for each tool station, grinding blocks and necessary wrenches, in a fitted hardwood case.

'60

As the first step in eliminating your own costly "cut and try" methods, write for Microbore Catalog No. 56.

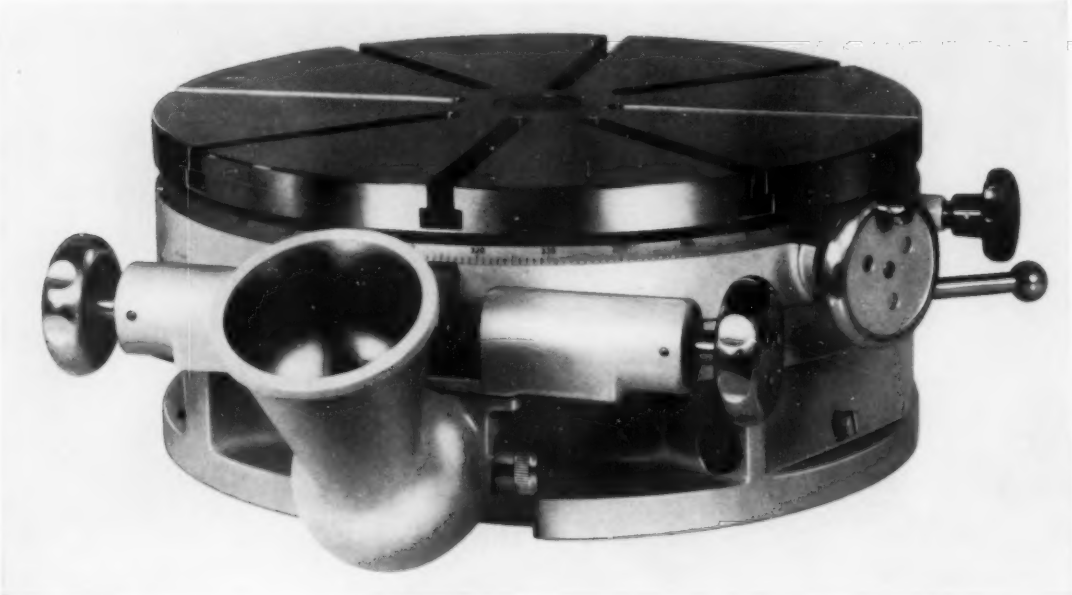
DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY
Fair Street • Royal Oak, Michigan

Use Reader Service Card, CIRCLE 18

Use Reader Service Card, CIRCLE 19

NEW Optical Rotary Table



CARL ZEISS

WEST GERMANY

Unlike conventional instruments, the new Carl Zeiss Optical Rotary Table is equipped with a graduated disc, which is imaged on a big, bright ground-glass (80mm diameter). This makes reading most convenient, speedy and non-tiring.

Its large chucking surface of 400mm diameter, precision setting of 6 seconds, and its sturdy construction enable it to meet the most exacting requirements.

Quick, approximate setting is made by means of a handwheel and a circular graduation of 360°, located on the rim of the instrument. The precise setting of the angular values is achieved by a fine adjustment knob while observing the ground-glass.

All mechanical and optical parts are contained in the housing, safe from dust and moisture.

CENTERING MICROSCOPE

True alignment of the machine spindle and axle of the rotary table is assured by a 20x microscope, placed in the machine spindle above a center point inserted in the rotary table. Both the center point and the centering microscope are equipped with a Morse taper 3. Therefore, if desired, the centering microscope can also be inserted in the rotary table and the center point in the spindle.

An epi-illuminating device can be used in conjunction with the microscope.

Write for booklet on the Carl Zeiss Optical Rotary Table

SOME OTHER CARL ZEISS INSTRUMENTS

Universal Measuring Microscope
Toolmaker's Microscopes
Optical Dividing Heads
Interference Microscope
Light Section Microscope
Gauge Block Interferometer
Circular Division Tester
Stereo Microscope
Technoscope

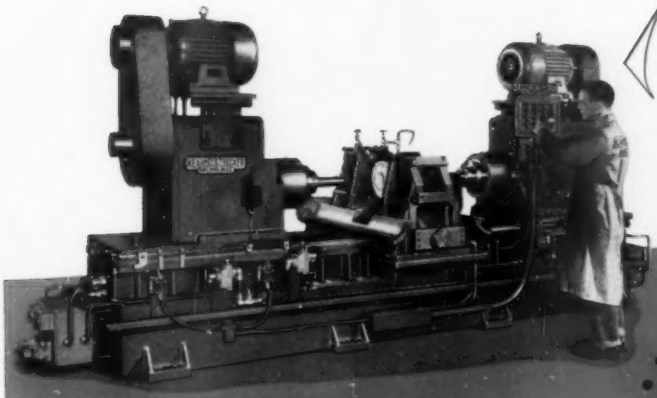
See us at the ASTE Show - Booth 1538

WISE OUR BOOTH '60 ASTE TOOL SHOW

CARL ZEISS, INC.

485 FIFTH AVENUE, NEW YORK 17, N. Y.

COMPLETE SERVICE FACILITIES



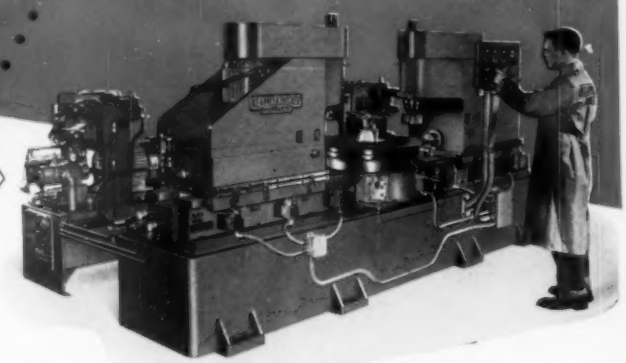
CONSTRUCTION INDUSTRY

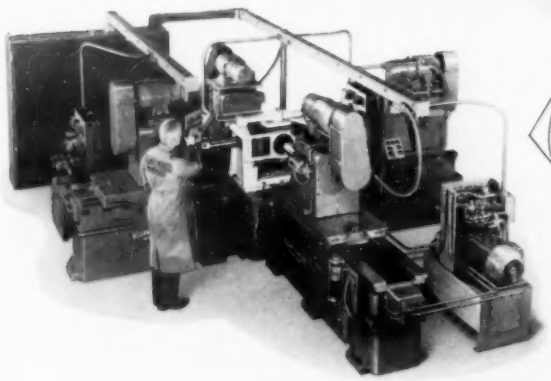
Only one setup is required to rough and finish bore, finish counterbore and face both sides of a tread roller for tractor-type construction equipment. Workpiece is hydraulically clamped . . . seven sizes of rollers can be machined. This method replaces a turret lathe using two setups. New rate is 13 pieces per hour.
Production up — 100%.

Kearney & Trecker builds PRODUCTION MACHINE TOOLS FOR EVERY INDUSTRY

AIRCRAFT INDUSTRY

Rotary feed, bed-type machine with two opposed vertical spindles mills both sides of aluminum pump body flange to critical thickness and smooth finish *at rate of 76 pieces per hour.* Unit is versatile . . . as many as eight types of pump bodies are milled using only separate fixtures and cams.





ENGINE INDUSTRY

This unit bores four holes in engine block simultaneously . . . replaces horizontal milling and boring machine that worked just one hole per setup. Interchangeable inserts allow operations on any of four different workpieces. One feed slide unit handles interchangeable heads.
Production — 10 pieces per hour . . . up — 400%.

ELECTRIC POWER INDUSTRY

Two-spindle machine mills both inside and outside radii of curved alloy steel turbine blade section in a single pass *at three times the former feed rate.* Versatile 360° drum fixture handles 81 different blade sizes without overtravel on rapid stroke for extremely short cycle time.
Production up — 300%.

Write for bulletin SMD-57 on your company letterhead or phone — GReenfield 6-8300 . . . Direct Distance Dialing Code No. 414.

KEARNEY & TRECKER MILWAUKEE ®

SPECIAL MACHINERY DIVISION
6800 W. National Ave. • Milwaukee 14, Wis.

SINCE 1898 . . . *Kearney & Trecker Customer Engineering Service — supported by an outstanding staff of engineers experienced in production milling machine design and application — combined with the finest and latest machine tools in an ultra modern plant, is always ready to solve your production problems.*

CALCULATED TO CUT COSTS

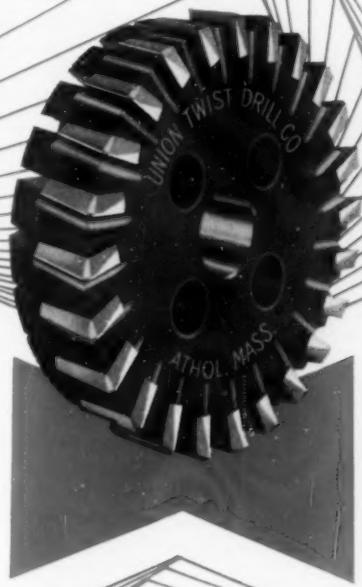
Geometric progression sets the pattern for exactly duplicating CARD gages. To users this assures consistently better performance and longer service life. Add these benefits to your own production by specifying CARD gages. Your CARD Distributor has a full line of gages, taps, dies and screw plates. For helpful advice on how to select and use them, see your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

Use Reader Service Card, CIRCLE 22



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Production of UNION cutting tools is like geometric progression. Each UNION milling cutter of the same size and type is precisely duplicated. This exact duplication brings valuable production benefits to every user. For more dependable performance, longer service life, specify UNION milling cutters, drills, reamers, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

Use Reader Service Card, CIRCLE 23

NEW the fastest and easiest method of marking...

THE ROTOR Airiter

Even on narrow edges or small parts... the Airiter makes its mark... fast and easy.

Rotor Tool announces a vastly improved method for marking all types of materials, such as metal, plastic, ceramic or glass. The new Rotor Model AR Airiter with its rapid-fire, short-stroke action and sharp stylus sets a new standard for versatile, easy, speedy marking of parts and tools.

No messy chemicals or risky heat are used. The Airiter has a simple reciprocating air motor, operates on a supply of 40 to 100 psi air pressure, up to 12,000 blows per minute. Its speed and depth of mark are controlled by the throttle *on the tool* and are infinitely variable to suit the job.

It will not stall while writing. No pressure regulator is needed. It's comfortable, no reaction to operator—as easy to write with as a pencil. It weighs only 5¼ ounces with hose, is only 5 3/16" long, has only three moving parts. Very low maintenance, precision-built to last. Its carbide stylus is readily sharpened or replaced. *And it is priced at only $49.50 plus postage.*

Try it in your shop and see how it writes circles around other methods! Send us your purchase order. Money refunded if, after a five-day trial, the tool is unsatisfactory. *The Rotor Tool Company, 26318 Lakeland Boulevard, Cleveland 32, Ohio.*

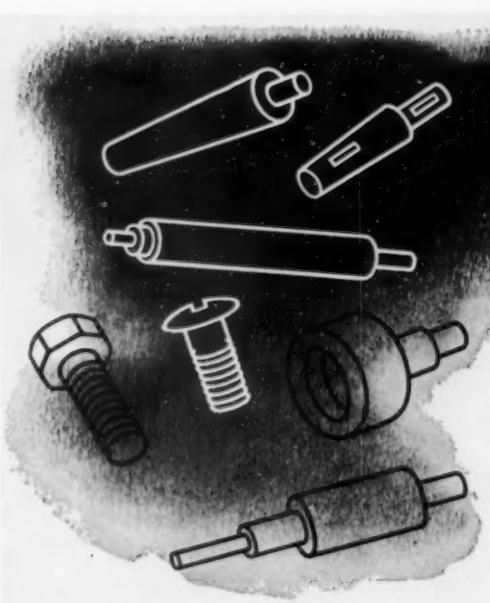
Only $49.50
plus postage

Here's the RIGHT TOOL for YOUR job!

ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers Special Tools • Air Motors

ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders

ROTOR TOOLS
The Rotor Tool Company · Cleveland, Ohio



Machine it! Put it to work!

Prehardened

VISCOUNT 44

High Strength Steel

No Further Heat Treatment Necessary!

Here's the high strength steel that cuts engineering and maintenance problems to the bone on maintenance and machine tool applications. Unexcelled strength, good toughness and increased wear resistance—these are the advantages of VISCOUNT 44, even when exposed to temperatures up to 1000°F.

More important, risk of size change and distortion of critically-engineered parts during heat treatment is completely eliminated. VISCOUNT 44 is furnished prehardened at Rockwell C 42-46 . . . it's practical to machine . . . easy to work!

Have a high strength steel problem? Call a Latrobe sales engineer today! Or, send for VISCOUNT 44 literature.

NOMINAL ANALYSIS

Carbon	.40	Chromium	5.00
Silicon	1.00	Molybdenum	1.20
Manganese	.75	Vanadium	1.00

plus Alloy Sulphides

MECHANICAL PROPERTIES

Furnished Hardness	RC 42-46
Tensile Strength	180,000-220,000 psi
Yield Strength (0.2% offset)	160,000-200,000 psi
Reduction of Area	40-50%
Elongation, 2"	10-15%
Coefficient of Expansion 80-1000°F	7.0 x 10^{-6} inches/inch°F

TYPICAL APPLICATIONS

Spindles • Shafts • Brake Dies • Forming Rolls • Tie Rods
Arbors • Axles • Bolts • Structurals • Cams

LATROBE Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and WAREHOUSES:

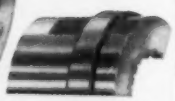
BOSTON • BUFFALO • CHICAGO • CLEVELAND • DAYTON • DETROIT
HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE • NEW YORK
PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO

HARDINGE
ELMIRA, N.Y.

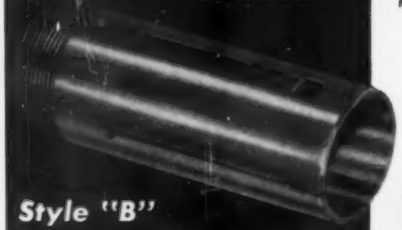
STANDARD EQUIPMENT in Progressive Screw Machine Plants

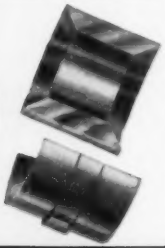
The Only MASTER COLLET With No Work Pressure on the Screw.

Style "S"
Master Collets and Pads



Pads Interchangeable Among Different Makes of Automatics



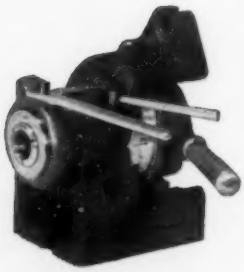


Style "B"
Master Feed Fingers and Pads

HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Style "S" Bulletin Style "B" Bulletin

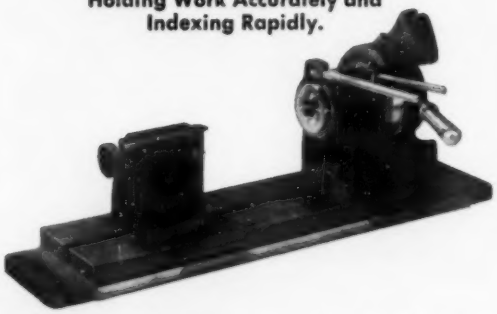
H-4 Tool Room-Inspection



HV-4 Production

HARDINGE COLLET INDEX FIXTURES

Increase Production by Holding Work Accurately and Indexing Rapidly.

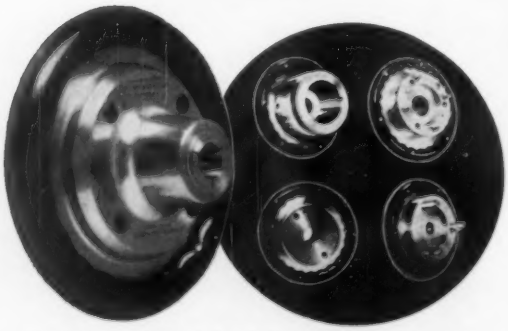


HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Bulletin CF8

HARDINGE-SJOGREN *Speed* COLLET CHUCKS

Fast — Accurate
Increase Production Capacity



Available in 1 1/16"; 1 3/8"; 2 1/4"; and 3 1/2" collet capacity. Threaded nose, cam lock, tapered key-drive and American Standard spindles. *Write for Bulletin 8A.*

HARDINGE BROTHERS, INC., Elmira, N. Y.

HARDINGE
ELMIRA, N.Y.

COLLETS for LATHES and MILLERS

ACCURACY — DURABILITY — LOW COST

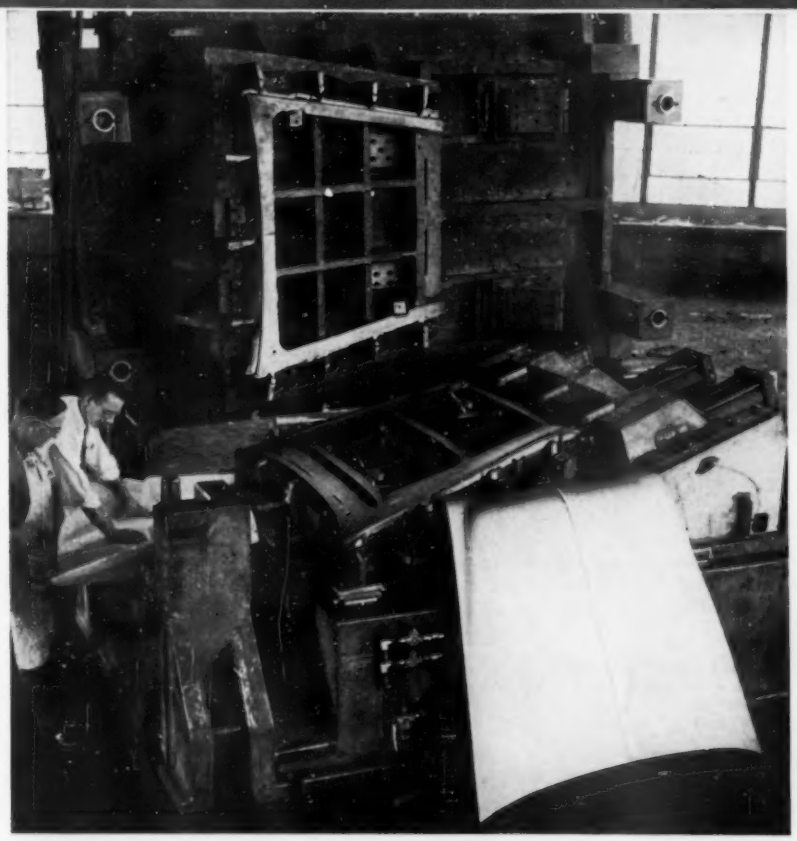
Write for Bulletin 56 — Complete collet ordering information for all Lathes, Millers, Grinders and Fixtures

HARDINGE BROTHERS, INC., Elmira, N. Y.

Immediate stock delivery from Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia, Seattle, Portland, Minneapolis, Oakland, St. Louis, Toronto.

Tool Steel Topics

BETHLEHEM STEEL



Automotive Die, in 101 Sections, Made from Water-Hardening Steel

This huge die, made up of Bethlehem W-1 carbon water-hardening tool steel, trims an automobile hood. Made from tool steel furnished by Peninsular Steel Co., Detroit, the die was photographed recently at Republic Die & Tool Company, Wayne, Mich. It contains 44 composite sections, 34 wear plates, and 23 solid sections.

Bethlehem carbon water-hardening steels were selected for this exacting application because of their good wear-resistance, easy machinability, and simple heat-treatment—plus ease of welding should repair become necessary.

Bethlehem carbon water-hardening tool steels, because of their carefully controlled hardenability, provide economical service in applications calling for high shock-resistance. And with their highly selective carbon range, they have good resistance to wear, plus the toughness to withstand cold battering.

If you have any questions about the use of Bethlehem carbon water-hardening tool steel, or any of our other popular grades, get in touch with your Bethlehem tool steel distributor. He's as near as your telephone.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here's How to Stabilize Gages

High-precision gages, commonly made of BTR tool steel (AISI Type 01), need a stabilization treatment if they are to maintain their accuracy for years. Otherwise expansion will eventually change dimensions outside of the permissible tolerance. These dimensional changes are in a magnitude of hundred-thousandths of an inch per inch, or smaller. Insignificant on ordinary tooling, they are important on precision gages.

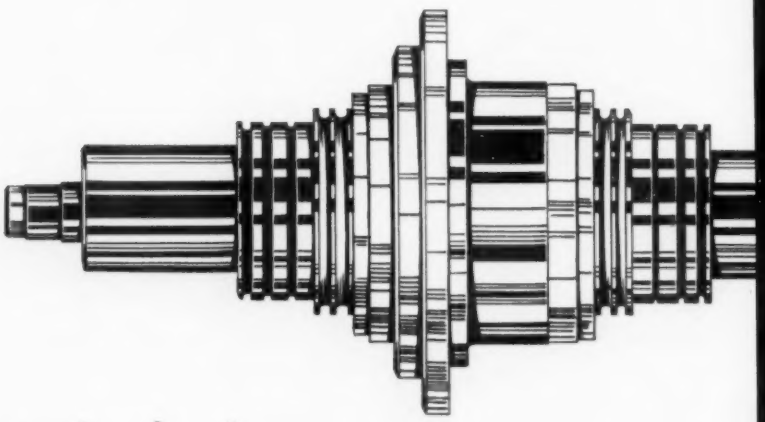
The expansion which occurs over a period of time is due to the transformation of austenite retained during the quench for hardening. The object of the stabilization treatments is to transform the retained austenite during the treatment, so that none remains which could transform later on. This condition exists in all tool steel grades which can be hardened to Rockwell C 60 or higher.

The most common method for stabilizing high-precision BTR gages is: 1. Quench and temper in the normal manner to produce the desired hardness. 2. Rough grind. 3. Subzero cool to minus 100/120 F in refrigerator or dry ice. 4. Warm to room temperature and then retemper at original temperature. 5. Finish grind to size. 6. Repeat cycles of subzero cool followed by tempering five more times. 7. Lap or superfinish to size.

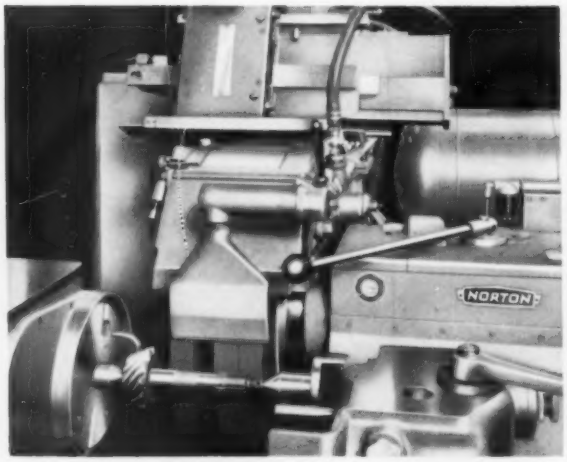
Sometimes it is possible to shorten this procedure, particularly if the design is such that there is little hazard of cracking. For example, the tools can be subzero cooled directly from the quench, with no interval at room temperature, followed by tempering and grinding. This will permit stabilization with only two additional cycles of subzero cool plus temper, but the disadvantage is that cracking may occur after quenching.

It is also possible to shorten the stabilization by cooling to minus 314 F in liquid air. This permits reducing the cycles of subzero cool plus temper to three instead of six.

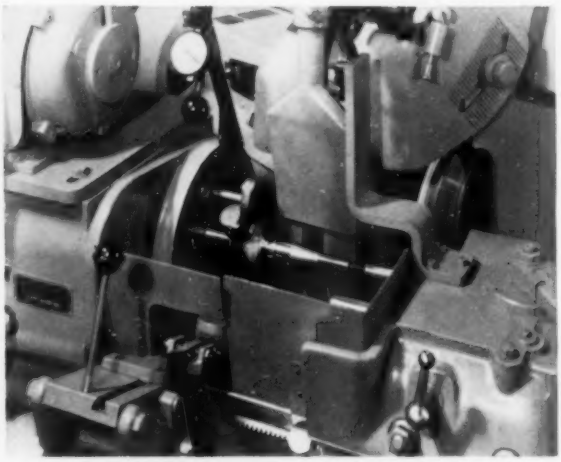
If you grind parts



combine your grinds in NORTON machines...like these



Grinding three stem pinion diameters on a Norton Type CTU Cylindrical Grinder. This multiwheel setup grinds three diameters in a single plunge cut, eliminating the need for separate operations. Norton automatic truing substantially increases the efficiency of multiwheel grinding.



Grinding a steering knuckle on a Norton Type CV-4 Angular Wheelslide Grinder with a dual wheel setup. Norton machines of this type offer unlimited opportunities to save time and effort when grinding several diameters, adjacent radii, and shoulders.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

like these...

If you're producing multi-diameter parts by grinding one O.D. at a time, here's a fact worth all the consideration you can give it:

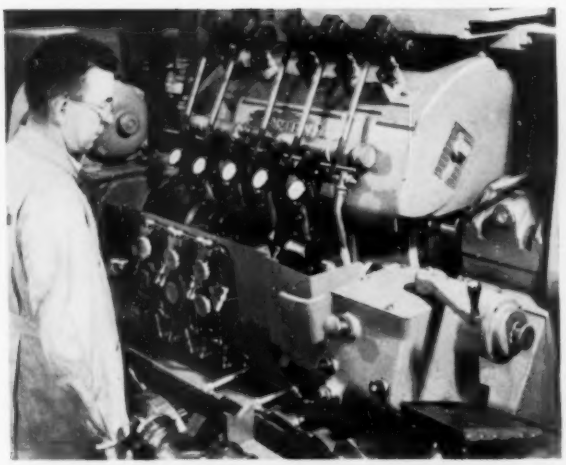
A single Norton Cylindrical Grinder will grind several surfaces at the same time — replacing two or more ordinary single-wheel machines and saving you considerably on purchase costs, operating costs and floor space.

On Norton center-type cylindrical grinders with straight or angular wheelheads, single or multiple wheels can be used to grind several surfaces simultaneously — including tapers, shoulders and plain or contoured diameters. Where wider wheel spacing is required, the heavy duty Type CM-1 Multiwheel Grinder can be used to good advantage for high speed, high production O.D. grinding.

Among the many time-and-money-saving features engineered by Norton for these machines, push-button actuated automatic wheel truing is one of the most outstanding advancements. This device provides close, uniform control of the amount of wheel face removed by the truing diamond, and trues the wheel or wheels either straight or formed, with speed and precision.

Get further facts on how Norton cylindrical grinders are bringing new efficiency and economy to O.D. grinding throughout industry. Your Norton Man, a trained grinding engineer, will be glad to show how these multi-grind, multi-wheel machines can benefit your own production. NORTON COMPANY, Machine Division, Worcester 6, Mass.

District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



Grinding multiple diameters on a crankshaft, this Norton Type CM-1 Multiwheel Grinder finishes the job in about the same time it would take a conventional machine to grind just one of these diameters. The massive wheel spindle holds a number of 36" wheels, properly spaced, within a wide span of 30".

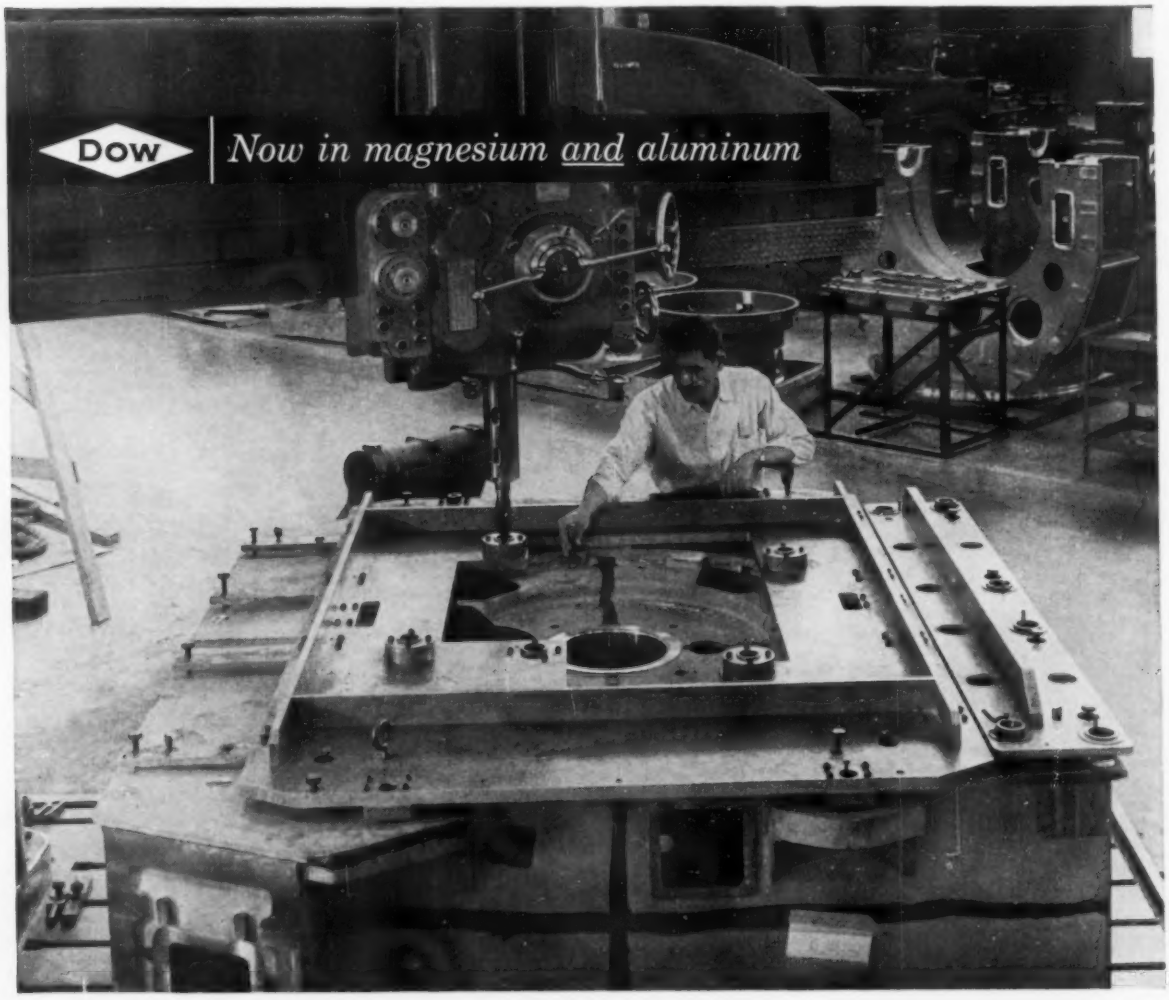
NORTON

MACHINE TOOLS

75 years of . . . **Making better products**

. . . to make your products better

MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners



TOTEABLE MAGNESIUM HELPS TOOL HUGE NIKE ANTENNA

"We're using more and more magnesium tooling plate in our shop because it's lightweight, easy to machine and has a superior finish," says the Director of Engineering of Steel Products Engineering Company Division of Kelsey-Hayes.

Light Weight. "We use magnesium tooling plate to make jigs and fixtures of various sizes up to seven feet square in our work on the huge Nike-Hercules antenna," he said. "The largest magnesium tools can be transported with a small lift truck, leaving our overhead crane free for other duties. Many of the magnesium tools can be handled easily by one or two men."

Machinability. "The excellent machinability of magnesium is very important since many operations must be performed to get the two sides of our jigs and fixtures parallel to .001."

Dimensional Stability. "Magnesium's dimensional stability allows us to hit milling and drilling tolerances on the finished antenna parts of .0002 to .0005."

NEW Magnesium Tooling Plate Manual covers shop working characteristics, properties, design. Contact the Dow sales office near you or write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Department 1030FJ-3.

VISIT US AT BOOTH 1050, ASTE TOOL SHOW

DOW **THE DOW METAL PRODUCTS COMPANY**

Division of The Dow Chemical Company

Now... A COMPLETE LINE OF SKINNER SOFT BLANK TOP JAWS

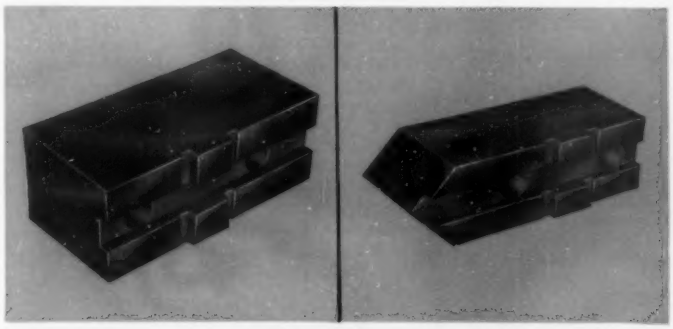
AVAILABLE FROM NEARBY DISTRIBUTOR STOCKS

...all manufactured to American Standard dimensions

- **Save time and tool costs**
- **Furnished in distinctive black**
- **Cost *less to buy* than to make yourself**

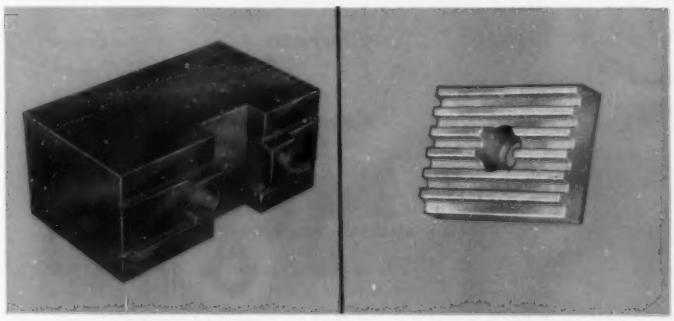
Now you can save time, money and delays by selecting from Skinner's complete line of Soft Blank Top Jaws for *all* chucks made to American Standard dimensions. Take advantage of fast, one-source service at your nearest distributor. His stocks are complete in all sizes and shapes. Call him today!

TONGUE AND GROOVE TYPE



MEDIUM DUTY—For Self-Centering Scroll Chucks, Independent Chucks and Combination Scroll Chucks.
HEAVY DUTY—For Power, Independent and Self-Centering Scroll Chucks.
These jaws can be used as supplied or shaped to meet specific requirements. Made from low carbon steel which can be easily carburized and hardened. Extra-high heavy duty top jaws are also available. The Long Pointed Jaws are designed so that points meet at center of work, permitting full use of chuck capacity.

SERRATED JAW TYPE and Master Keys



For Heavy Duty Power and Scroll Chucks
These jaws also can be used as supplied or shaped to meet specific requirements. They are processed to resist rust and can be easily shaped, carburized and hardened. Screw is supplied when jaw and corresponding key are purchased together—permitting key and jaw to be stored assembled as a matched set.

Serrated Master Keys: Precision-machined from top quality, hardened steel. Serrations are so machined that by reversing master key 180°, the top jaw can be adjusted to ½ the pitch of the serrations. This feature permits easy adjustment of the top jaws in reference to the work.

HEAT TREATING INSTRUCTIONS INCLUDED WITH ALL BLANK JAWS

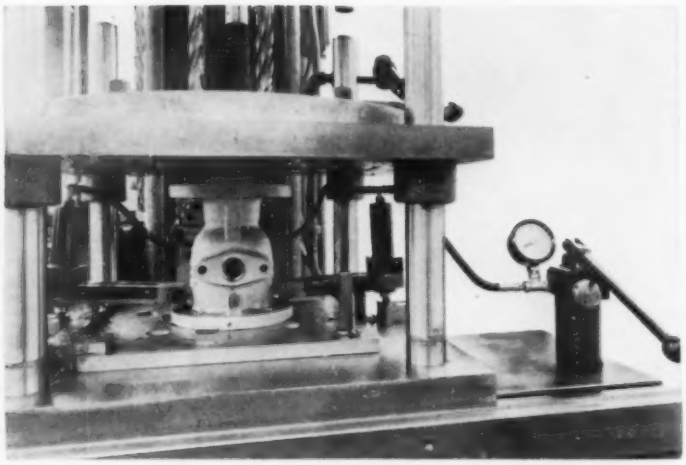
Ask your distributor for folder showing complete range of sizes and shapes or write to the address below, Department 183.

THE CREST OF QUALITY

SKINNER CHUCKS

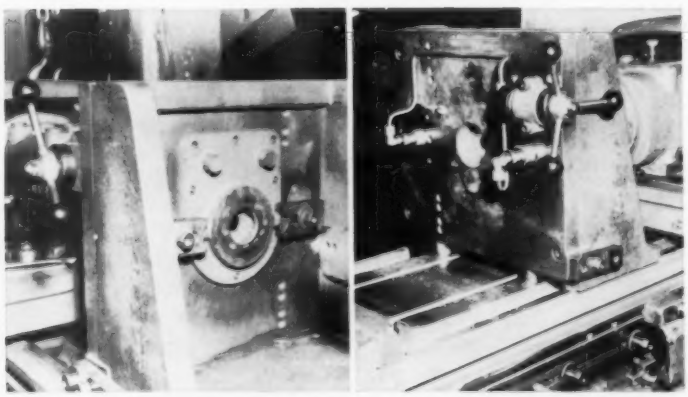
THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT

What other shops found out about Hydraulic Clamping



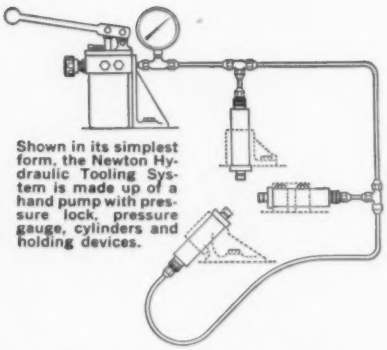
LODDING ENGINEERING SAVES MORE THAN 2½ HOURS A DAY . . . since its switch from manual to Newton Hydraulic Clamping, reports Edward Bedard, Lodding Plant Superintendent. Former manual method took 22 minutes — 14 clamps for each set-up. Newton System reduced number of clamps required to two, with one manual operation. Repositioning takes 4 minutes per set-up which, done 3 times daily, saves nearly an hour in set-ups. Another 105 minutes per day is gained in production time. Total time saved — over 2½ hours a day. Mr. Bedard also states, "We can pay for this unit every two weeks, if we include our installation time." Shown is a multiple drill fixture.

(Lodding Engineering Corporation, Auburn, Mass., is the leading manufacturer of doctors and doctor blades for the pulp and paper industry.)



KINNEY CUTS CLAMPING TIME 90% PER PIECE . . . since the application of Newton Hydraulic Tooling to the clamping parts in a precision boring operation (illustrated above). "Actual clamping time per piece decreased by 90% and floor to floor time decreased by 67%," states Melvin S. Naiman, Tool Engineer at Kinney Manufacturing Co. With the stud and nut arrangement originally used, the machine operator experienced difficulty in tightening clamping nuts with a wrench. "Complete elimination of this drawback," Mr. Naiman reports, "was the result of changeover to hydraulic cylinders. Operator's clamping motions have been reduced to a single rotation of the screw pump handle."

(Kinney Manufacturing Company, Boston, Mass., is a division of New York Air Brake Company.)



Shown in its simplest form, the Newton Hydraulic Tooling System is made up of a hand pump with pressure lock, pressure gauge, cylinders and holding devices.

Further advantages of Newton Hydraulic Clamping

Besides speeding production by reducing set-up time, the Newton System is easy, safe and economical to operate. Uniquely versatile, any number of clamping cylinders can be used up to the fluid capacity of the hand pump. A multiplicity of clamping positions can be achieved — horizontal, vertical, angular, swing, trunnion. Unexcelled for clamping odd-shaped pieces. Clamp pressure is uniform throughout the system, rigidly controlled, indicated by a gauge. Operating pressure is in the 2000 — 2500 psi range. The system is self-contained with no outside source required to maintain pressure. Both screw and lever pumps, equipped with pressure locks, available in two sizes — cylinders in varied size ranges. Air actuated hydraulic pumps, also available in two sizes.

HYDRAULIC SYSTEM PROVIDES:

- **Rapid operation of clamps in jigs and fixtures**
- **Controlled clamping pressure**
- **Self-contained clamping — independent of external power sources**
- **Versatility of clamping applications**
- **Safety, simplicity and economy of operation**
- **A variety of pumps, cylinders and mounting devices**

Send for complete information and catalog.

A Newton engineer will be happy to sit down with you to discuss your particular clamping problem and to give advice on the type of equipment best suited to your needs.

. . . clamps down on set-up time

NEWTON

HYDRAULIC TOOLING CO., INC.

AUBURN, MASSACHUSETTS

See Newton Systems demonstrated at Detroit A.S.T.E. Show April 21 — 28
BOOTH NO. 1627

ANOTHER "BUILDING BLOCK" BY

HARTFORD *Special*

THE **NEW** Model 17-400

AIR HYDRAULIC DRILL UNIT

- 4" STROKE • UNITIZED
- SMALL SIZE • INTEGRAL AIR VALVE
- FIELD TESTED

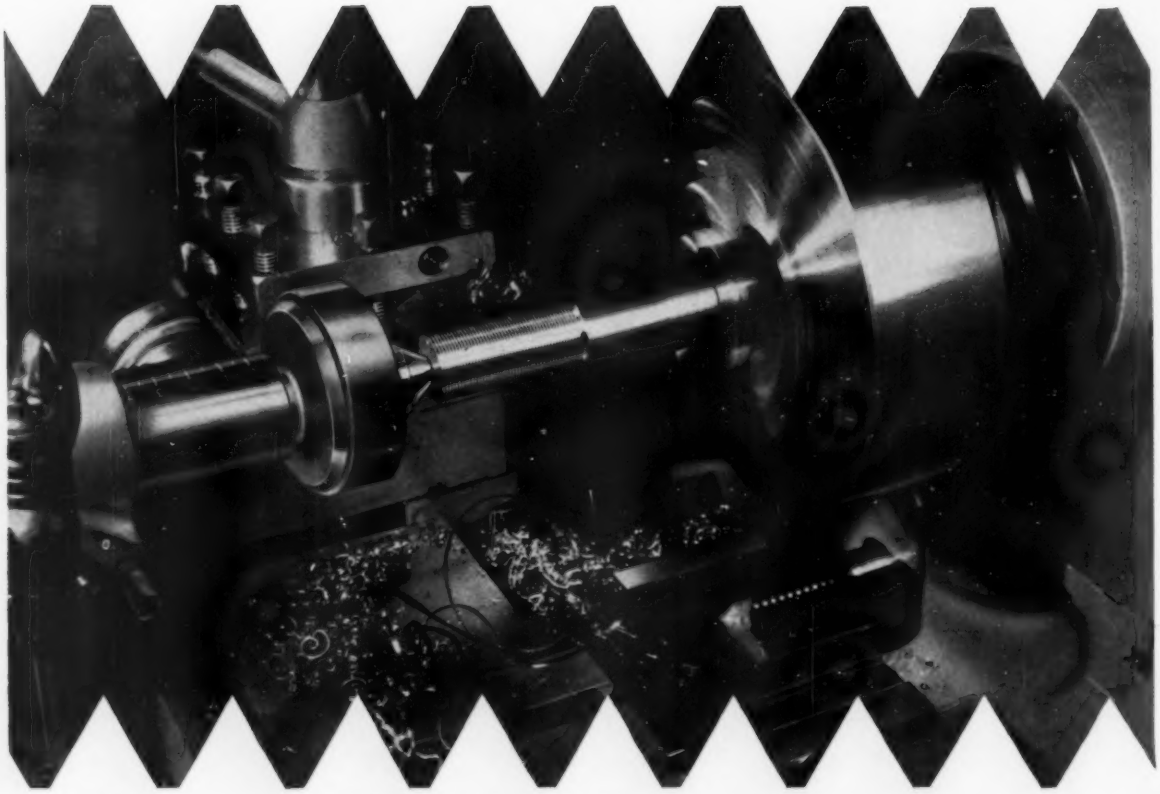
COMPLETE INFORMATION . . . on the new Model 17-400 Drill Unit, including dimensions, specifications and other engineering data, is covered in Circular No. GC-400. Write now for your free copy.
The Hartford Special Machinery Co.,
3800 Homestead Ave., Hartford 12, Conn.

VISIT OUR BOOTH
DETROIT ✱ '60 APRIL 21-28
ASTE TOOL SHOW

Booth 1723

HARTFORD *Special*

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD 12, CONNECTICUT



Now . . . cut threads 5 times faster with Clausing geared-head lathes

The Clausing-Colchester 13", 15", 17" geared-head lathes equipped with new high speed thread cutting unit—

(1) Cut threads five times faster than by normal methods

(2) Thread tight to a shoulder at maximum speed

(3) Cut internal threads without undercutting

(4) Take full advantage of carbide tools

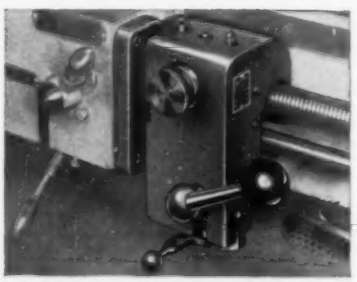
(5) Minimize rejects

(6) Unit does not restrict normal use of the machine

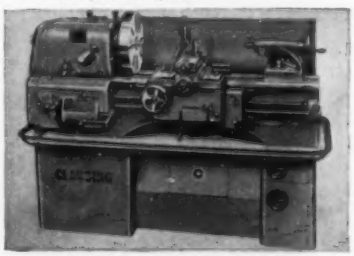
Cutting a 1⅛"—16 thread . . . at 1200 RPM . . . is an example of the production obtained with this unit on a Clausing lathe. And you cut precision threads every time! The Hi-Speed Unit contains its own half-nuts and engagement mechanism that eliminates all danger of a thread being "picked up" incorrectly. The tool can't run into the work or chuck—an adjustable stop disengages the half-nuts automatically at the end of the thread.

Clausing geared-head lathes are bigger in capacity. Have larger spindles, larger thru-hole capacity, larger bearings for heavier work. Geared-head is powered thru multiple V-belts. See for yourself the many *plus* features you get in Clausing lathes equipped for high speed thread cutting.

Write for FREE LITERATURE



Operation of the thread cutting unit is simple and fool proof. There's no revolving dial to watch—no manual coordination to require slow speeds.



15" Clausing-Colchester lathe with high speed thread cutting unit . . . only $3,626.

CLAUSING

CLAUSING DIVISION
ATLAS PRESS COMPANY
3-114 N. PITCHER ST. • KALAMAZOO, MICHIGAN

Use Reader Service Card. CIRCLE 34

Use Reader Service Card. CIRCLE 35

cool · tough

DASCO SUPER SOLUBLE BASE

water-mix cutting fluid

Stuart

Under adverse conditions—on jobs too difficult for regular water-mix cutting fluids, yet not suited for straight petroleum oils—Stuart's Dasco Super-Soluble Base will improve performance and profits, reduce costs.

Here is a water-mix cutting fluid with a sulfochlorinated fatty oil base that assures proper chip formation, prevents welding, and reduces heat-generating friction under extreme circumstances. It is a heavy-duty soluble oil that permits machining of stainless, low carbon steels, monel, and jet engine alloys with economical tool life and fine surface finish.

Even at slow cutting speeds, the chemically active extreme pressure additive in Dasco Super-Soluble provides antiweld protection at the tool-chip interface—prevents edge build-up and cratering of tools.

Dasco Super-Soluble gives you high lubricity, antiwear, and antiweld qualities, plus the high cooling capacity inherent in a water-mix cutting fluid. It is ideal for heavy-duty turret lathe work, high-speed turning with carbides, tough form milling, boring, and surface or round-hole broaching. Use it at 40 to 1 for turning, drilling, milling, boring, sawing, and reaming—15 to 1 for broaching.

here comes real detergency

Stuart's new Hi-D

transparent metalworking compound

Stuart

Hybrid compound keeps grinding wheels open and free-cutting, minimizes machine tool maintenance.

Now, today, there is a metalworking compound that offers extra-high detergency for stress-free grinding, yet does not attack paint, remove way lubricant, or leave crystalline deposits on the machine . . . that lubricates as it cleans, yet does not leave an oil film on the chuck . . . that is just as clear as any synthetic compound, yet is a petrochemical-type solution that is effective and stable at 60:1.

Hi-D is one of the outstanding lubrication developments in Stuart's 90-year history. Yet, it costs less per drum than most "coolants"—up to ⅓ less at proper dilution than some high-priced cutting fluids.

No other cutting and grinding compound is anything like it. Best described as a hybrid, it has all the qualities you look for in a synthetic without any of the disadvantages.

D. A. STUART OIL CO., LIMITED
2727 South Troy Street, Chicago 23, Illinois

Canadian D. A. Stuart Oil Co., Limited, P. O. Box 430, 43 Upton Road, Scarborough, Ontario, Canada

To Achieve the Optimum in Tool Design... the Ultimate in Performance...

Typical of the continuing forward progress in manufacturing techniques which has characterized its service to the metalworking industry, National Tool offers a facility to provide the ultimate in accuracy and speed.

Introduction of the Bendix G-15 Digital Computer into its tool engineering system obtains by electronic computation a complete analysis of part and tool elements . . . attaining the highest levels of speed and accuracy. Accomplishing what formerly required hours or even weeks of manual calculation, completely validated results are possible in a matter of minutes.

Optimum tool design, development of absolute specifications to micro-measurements for mating parts, accuracy and tolerance factors hitherto impossible . . . these are among the many production benefits that lead to longer, more efficient tool life.

NATIONAL Tools CLEVELAND

NATIONAL TOOL COMPANY
A Division of
National Cleveland Corporation
11200 Madison Avenue Cleveland, Ohio

For more than a half century National Tool has supplied high quality precision cutting tools to the metalworking industry.

For your special cutting tool requirements call your National Tool representative.

Versatile, flexible, and with unlimited application range, data can be fed into the Computer for single or repeat solutions . . . memory stored and automatically available.

Announcing

an important new development for quality control measurement

AMES MODEL AG7

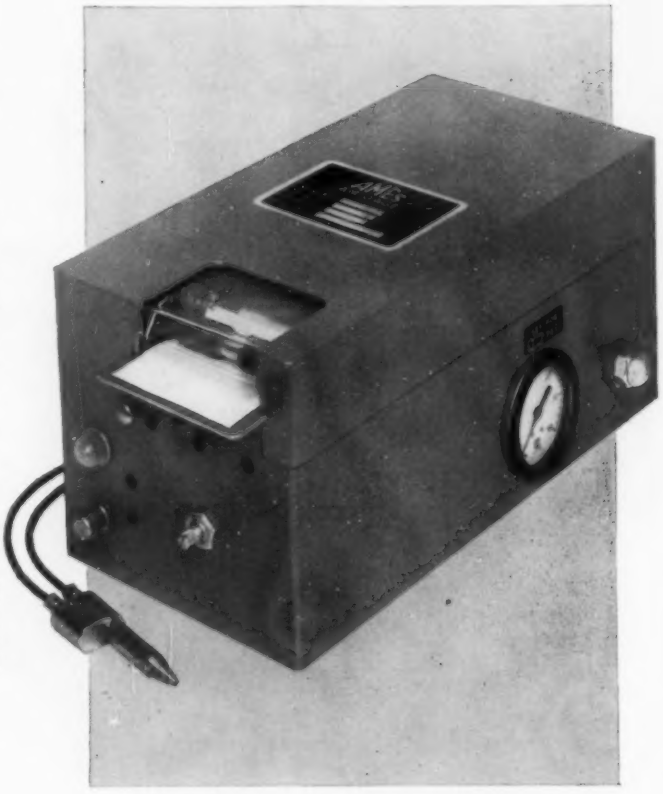
Accu-Flow* Air Gage Recorder

A permanent record of continuous measurements can be made in magnifications of 1750 to 1—3500 to 1—and 17,500 to 1.

Measurements are recorded by a "hot needle" on 2"-wide chart paper. The width of the paper may be made to equal measurements as small as a tenth of one-thousandth or as wide as four-thousandths. This allows the reproduction of minimum graduations representing two millionths or twenty millionths of an inch.

The AG7 provides a completely impersonal measurement record that can be used both as a controlling device and as a means of furnishing visible "proof of precision" to buyers of the measured products. Send for free ACCU-FLOW FOLDER.

*Trademark of B. C. Ames Co.

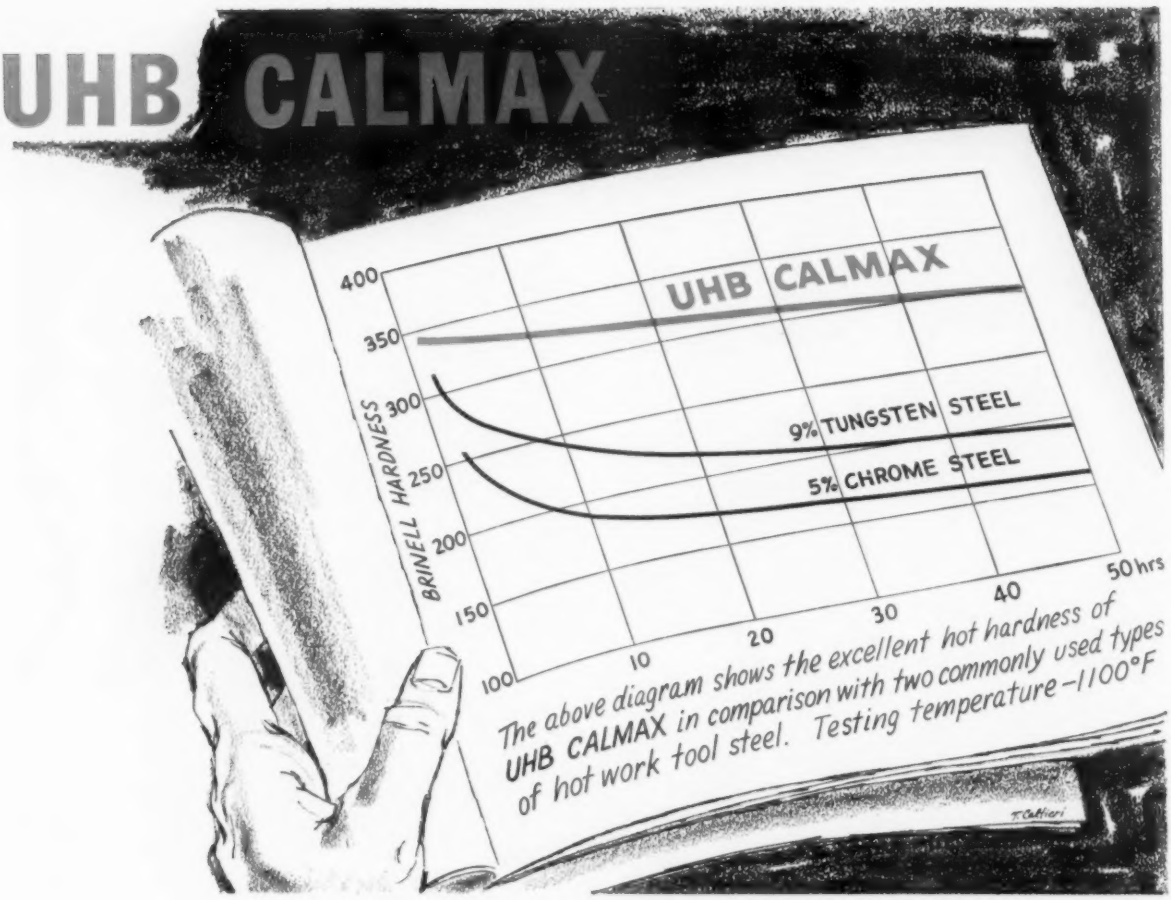


Representatives in Principal Cities

B.C. AMES CO. *30 Ames Street, Waltham 54, Mass.*

Canadian Representatives—H. C. Burton Co. Ltd., Hamilton

MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAGES



A New HOT WORK Steel
For Your Most Severe Applications!

UHB CALMAX is the latest Uddeholm development to meet your highest demands for hardness, wear resistance, mechanical strain and impact at elevated temperatures. It is a chromium-tungsten-cobalt steel and, when cooled in air, hardens through in all sizes. In years of testing by a major non-ferrous manufacturer, UHB CALMAX demonstrated extraordinary stand-up-ability to heat checking and wear. For hot press-forging, die casting, and extrusion of copper, copper alloys, and other materials with high melting points, UHB CALMAX outperformed 9% tungsten and similar grades of hot work steels by more than 3 to 1. In one instance, UHB CALMAX cores for die casting brass produced 15,500 parts, as opposed to 5000 with a 9% tungsten steel. The air hardening properties make heat treatment safe and easy. Distortion after heat treatment is insignificant!

If you need a steel that is simple to harden and that has a high hot-hardness, excellent resistance to wear and heat checking, contact your nearest Uddeholm office, today!

Ask for the UHB CALMAX pamphlet!

UHB
TOOL AND DIE STEELS
COLD ROLLED SPRING STEELS

UDDEHOLM COMPANY OF AMERICA, INC.
155 East 44th Street, New York 17, N. Y. • MUrray Hill 7-4575

BRANCH OFFICES & WAREHOUSES: Long Island City, N.Y.: 22-14 37th Ave., MUrray Hill 7-4575 **Cleveland:** 4540 East 71 Street, DIamond 1-1110 **Los Angeles:** 5037 Telegraph Road, ANgelus 2-5121 **Newington, Conn.:** 2175 Berlin Tpke., P.O. Box 136, MOhawk 6-5461 **DISTRICT REPRESENTATIVES: Chicago:** Frank J. Mackin, Leroy E. Marshall, 55 East Washington, STate 2-1649 **Detroit:** Warren H. Nugent, 17304 Lahser Road, KEnwood 5-6340 **Philadelphia:** Frank T. Campagna, 1418 Walnut St., PEnnypacker 5-2114 **TOOL STEEL WAREHOUSE DISTRIBUTORS: Rockford, Ill.:** Rockford Industrial Steel Service, 2229 Twenty-Third Ave., WOodland 3-5463 **Utica, N. Y.:** Pacemaker Steel Warehouse, Inc., 1604 Lincoln Ave., REdwood 5-6484

You get 4 big advantages with all 4

CLEVELAND *New Style* COUNTERSINKS

SINGLE FLUTE

The high positive rake and single flute construction assure burr-free holes and chatterless operation over a wider range of speeds and feeds. Suggested for pre-drilled or pre-formed holes that are too small for a 3-flute countersink.

THREE FLUTE

Especially useful in portable work, because they center more readily. Engineered to give chatter-free performance in both countersinking and deburring operations. Assure better tool life in most applications.

1. **Easy feeding**
2. **Long tool life**
3. **Burr-free holes**
4. **Better finish**

Many tests in customers' plants have proved that the newly designed CLEVELAND New Style Countersinks give *outstanding performance* in all materials . . . on both machine and portable equipment . . . and operate without chatter over a wider range of speeds and feeds than ever before possible.

The High Speed New Style Countersinks (Single Flute and Three Flute) are available in body diameters of ¼″ to 1½″, with included angles of 60°, 82°, 90°, 100°, 110° and 120° for sizes up to 1″, and angles of 60° and 82° for the 1½″ size.

The Carbide Tipped New Style Countersinks (Single Flute and Three Flute) come in body diameters of ¼″ to 1″, with included angles of 60° and 82°.

Write for your copy of this Helpful New Folder

Gives recommendations for countersinking holes in various materials, in both portable and machine work. Illustrates methods of regrinding. Lists the sizes and point angles of the new Countersinks.

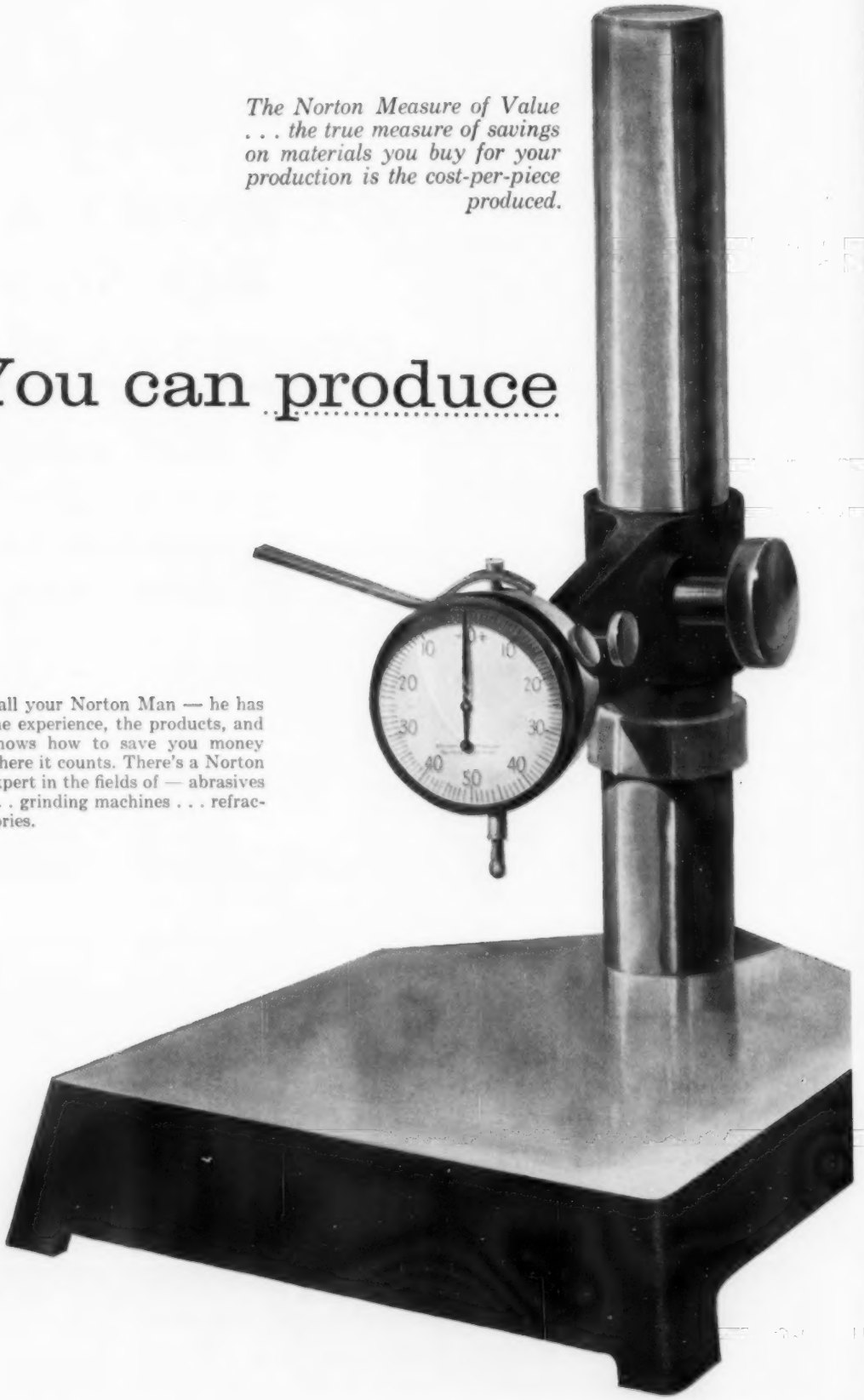
TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR
for CLEVELAND Quality Tools . . . *prompt delivery from stock*

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York • Atlanta • Cleveland • Detroit • Chicago • Dallas • Los Angeles • San Francisco

The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

You can produce

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.



greater savings than you can buy

You can't recognize a value by its price alone. This is true of all types of grinding wheels and has special significance in diamond wheels in view of their high initial cost.

The price tag on a diamond grinding wheel may appear to be a good "buy", but the real consideration should be what will you get for your money?

Diamond wheels less expensive than Norton may save you money on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — the price you paid is too much.

The only accurate measure of the value of any grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton diamond grinding wheels are worth more to you . . .

Norton Company introduced all three diamond wheel bond types — does all its own sizing and checking of diamonds — duplicates wheel specifications with constant accuracy. Whether the diamonds you use in carbide grinding are mined or man-made, Norton gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field. And you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years' abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

Ask him to make an Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems. For example . . .

Your Norton Man can increase production by pointing out ways for effective wheel usage. He has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

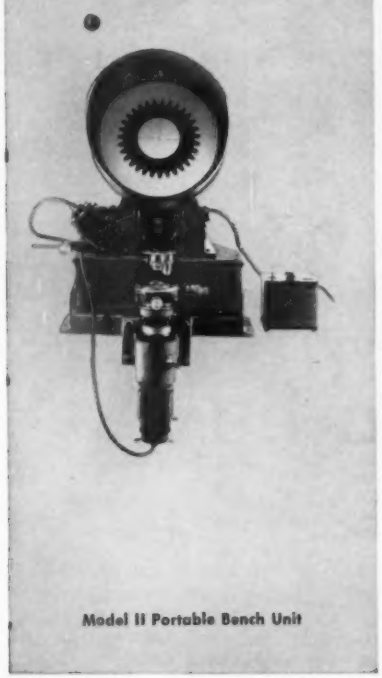
Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass.

W-1957

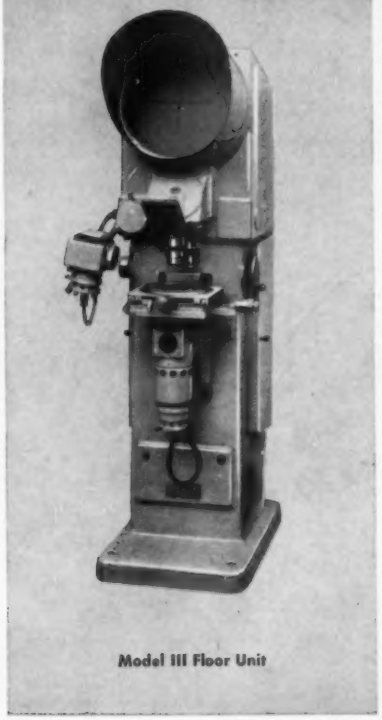
NORTON
ABRASIVES

75 years of . . . **Making better products . . . to make your products better**

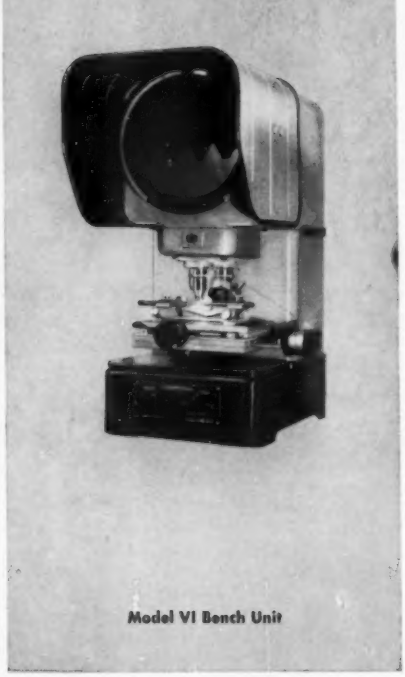
NIKON OPTICAL COMPARATORS



Model II Portable Bench Unit



Model III Floor Unit



Model VI Bench Unit

3 models for accurate inspection of precision parts

Whatever your inspection needs – whatever your budget considerations – there's a Nikon Optical Comparator to meet the demands of both. For Nikon has successfully fulfilled the two most pressing requirements in industry – *outstanding performance at moderate cost.*

Whichever of these three models you select, you will discover the same demonstrable qualities in each: bright screen illumination, sharp edge-to-edge definition, ease and speed of operation, and an almost unlimited versatility. You will be especially impressed with the high accuracy of performance, the simplicity of mechanical design, and the ruggedness of construction.

Nikon comparators may be used for surface as well as contour inspections – simultaneously, if desired. The inherent versatility of the Nikon is even further extended by the availability of a wide assortment of accessories for general and special applications: lenses covering a wide range of magnifications – 8 different stages – goniometers – fixtures – charts – vernier protractor screens – and photo-recording equipment.

NIKON Model II Portable Bench Unit –

Ready portability is one of its major advantages. It can be easily carried from one part of the plant to another for accurate on-the-spot inspections and measurements – with minimum loss of down time. Equipped with 3-lens turret.

NIKON Model VI Bench Unit –

Offers many advanced features: hand-wheel control for fine focusing, built-in illuminator for surface inspection, built-in blower system, bayonet mount for rapid lens interchangeability. Also available with bayonet, 3-lens turret.

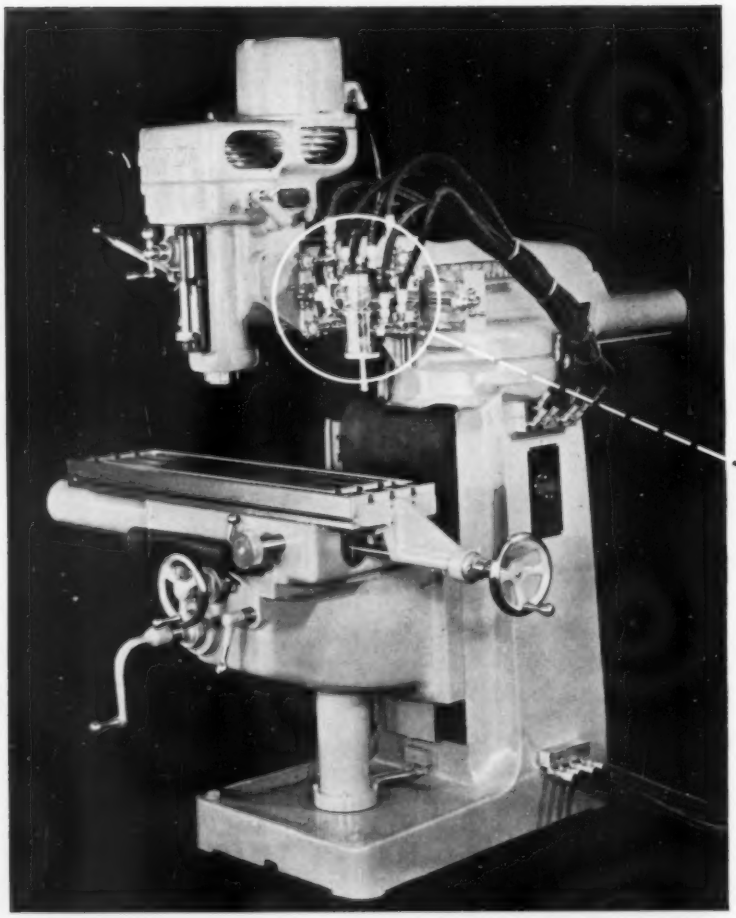
NIKON Model III Floor Unit –

A rugged unit of extreme efficiency and accuracy – completely self-contained in cast aluminum housing. Fine movement focusing system employs lead-screw drive with scraped ways and adjustable gibs. Equipped with 3-lens turret.

For illustrated catalog, complete specifications and prices of all units and accessories, write to: Dept. TE-3.

NIPPON KOGAKU TOKYO **NIKON INCORPORATED** • 111 Fifth Avenue, New York 3, N. Y.

Now "Micrometer Accuracy"
Applied to Hydraulic Tracer Control
Provides more speed in Production Profiling and Duplicating



Gorton Trace-Master Hydraulic Tracer control is today's best unit for 2- and 3-dimensional duplication, production profiling and work on all types of die forging, die casting, metal stamping, embossing and coining, as well as plastic molds in both ferrous and non-ferrous materials.

GORTON

"TRACE MASTER"
Supersensitive Hydraulic Control

This master control valve is manufactured to tolerances which are NEW in the field of hydraulics. Working parts are so delicately ground and lapped that they will operate only with a very fine grade of special oil. *Ordinary hydraulic fluids are wholly unsuitable.*

3 MODELS AVAILABLE

180° Vertical Hydraulic Feed to Knee.

360° Cross Hydraulic Feed to Ram and Longitudinal Hydraulic Feed to Table.

3D Hydraulic feed to knee, ram and table for 3-dimensional work.

The above can be furnished with the Gorton 1-22 Mastermil illustrated here or the Gorton 9-J Super-Speed Vertical Mill with single spindle, twin spindles and/or six inch higher column for additional vertical capacity.

Write for complete information contained in bulletin 2771.

GORTON

GEORGE GORTON MACHINE CO.

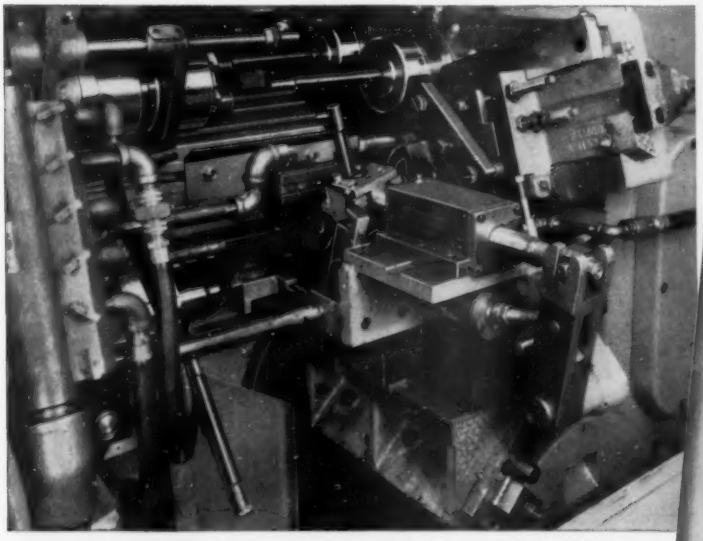
2610 Racine Street • Racine, Wisconsin

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A7-1002-1P

3/4-16 thread is cut in 3rd position, 3/4-10 in 4th. Piece is rotated end-for-end by transfer attachment.



Lead-Screw Threading

To Tenths of Thousandths

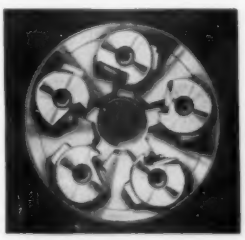
. . . With National Acme 5-Chaser Vers-O-Tools

"Run-out, pitch diameter and pitch variation of the threads on these 3/4-inch studs can't be off more than 1/1000 inch. And, the overall tolerance of the finished piece must necessarily be held to tenths of thousandths." These were the exacting threading requirements of one of the country's leading builders of diesel electric locomotives. 4-chaser heads had failed to meet specifications. But National Acme 5-Chaser Vers-O-Tools, on an Acme-Gridley RB-6 Automatic, arranged for a double-index setup, met the critical threading requirements with ease, producing consistently superior threads at lower cost.

Thousands of users of Namco 5-Chaser Vers-O-Tools have realized similar cost-savings. Here's why . . .

- Out-of-round and drunken threads are eliminated
- Chasers can be ground closer to center, giving smoother, more accurate threads
- 5 chasers lighten chip load on each tool
- Longer chaser life per grind—less machine downtime
- 5 chasers permit threading of parts with flats, slots, keyways

Write for complete information on how Namco 5-Chaser Vers-O-Tools can provide the tolerances and finish for *your* toughest threading job.



National Acme

THE NATIONAL ACME COMPANY
193 E. 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

Now! Finish parts up to 100 times faster,

The AIR-vibr

...the latest method for CLEANING,

radiusing, fine-finishing, coloring and burnishing all metal and metal alloy parts, many suitable plastic and ceramic items. The Pangborn Air-Cushioned Vibratory Finishing Machine—culmination of Pangborn's years of experimentation and refinements*—obsoletes precision barrel finishing.

The Pangborn Air-Cushioned Vibratory Finishing Machine gives you wider range of application, larger payloads and greatly-reduced time cycles resulting in tremendous savings. It easily handles parts too delicate and intricate to finish by other methods . . . works on shielded areas and interior surfaces . . . does coarser jobs faster and better *with impressive cost reductions.* You'll find it perfect for castings, forgings, stampings, machined and pressed parts!

Available in 1½, 3, 6, 12 and 18 cu. ft. net capacity sizes. Send parts with exact finish specifications for sample processing in our laboratory . . . witness production runs of your work.

*Pat. No. 2,422,786; June 24, 1947

Benefit from the expert knowledge and services of Mr. William E. Brandt, Vibratory Finishing Division.

Mr. William E. Brandt

better and at a greatly reduced cost!

secret—

CUSHIONED

DESCALING, DEBURRING, GRINDING,

THE PANGBORN AIR-CUSHIONED VIBRATORY FINISHING MACHINE OFFERS THESE EIGHT IMPORTANT ADVANTAGES:

- **Works up to 100 times faster than conventional methods; does more work BETTER at LOWER COST**
- **Does work impossible to do by barrel finishing or other means**
- **Has wider range of application**
- **Saves manpower, floor space and operating overhead**
- **Sturdiest and most compact vibrator on the market**
- **Air cushion support and suspension for automatic leveling and amplitude control supplants spring suspension systems subject to fatigue**
- **Standard basic machines are equipped with mechanically variable speeds**
- **Floor vibration entirely eliminated making possible (for the first time) second floor mounting**

Send coupon below to: Vibratory Finishing Division, PANGBORN CORPORATION, 4700 Pangborn Blvd., Hagerstown, Maryland.

Pangborn
OF HAGERSTOWN

☐ Please send details on Pangborn Air-Cushioned Vibratory Finishing Machine.
☐ Please have representative see me about a laboratory demonstration on my work.

Name..... Position.....

Company.....

Address.....

City..... Zone.... State.....

THEY SPEND MORE pennies

TO MAKE MORE dollars

Without coolant, this Bullard lathe makes a .125 rough cut and .050 finish cut using Kennametal Grade K6 inserts in a Kendex* (patented) holder. Sand holes in the castings add to the difficulty of an interrupted cut. Photos and production data courtesy of American Coleman Company, Littleton, Colorado, manufacturers of trucks, tractors, front drive axles, and related parts.

	50 RPM 24 Minute Tool Life	88 RPM 15½ Minute Tool Life
Feed	.027	.027
Cutting Time:		
First side—rough cut	7 minutes	4½ minutes
First side—finish cut	7 minutes	4½ minutes
Second side—rough cut	5 minutes	3¼ minutes
Second side—finish cut	5 minutes	3¼ minutes
Total cutting time	24 minutes	15½ minutes
Machine cost per hour	$6.00	$6.00
Tool cost per hour	.075	.27
Machine and Tool cost/8 hours	$48.60	$50.16
Pieces finished per 8 hours	5	9
Cost per piece	$9.72	$5.57

KENNAMETAL* tooling permits 75% SFM increase... cuts cost per piece almost in half

Like many others, this plant is sacrificing pennies in tool costs to make dollars in production profits. At 50 rpm, this boring mill faced cast iron housings at a maximum speed of 289 sfm. Each Kennametal cutting edge faced both sides of two pieces with production averaging 5 pieces per 8-hour shift. When the maximum speed was increased to 510 sfm, the cutting insert had to be changed for each piece.

This reduction in machining time, plus some additional time saved by an improved method of holding the workpiece, enabled production to increase to 9 pieces per shift.

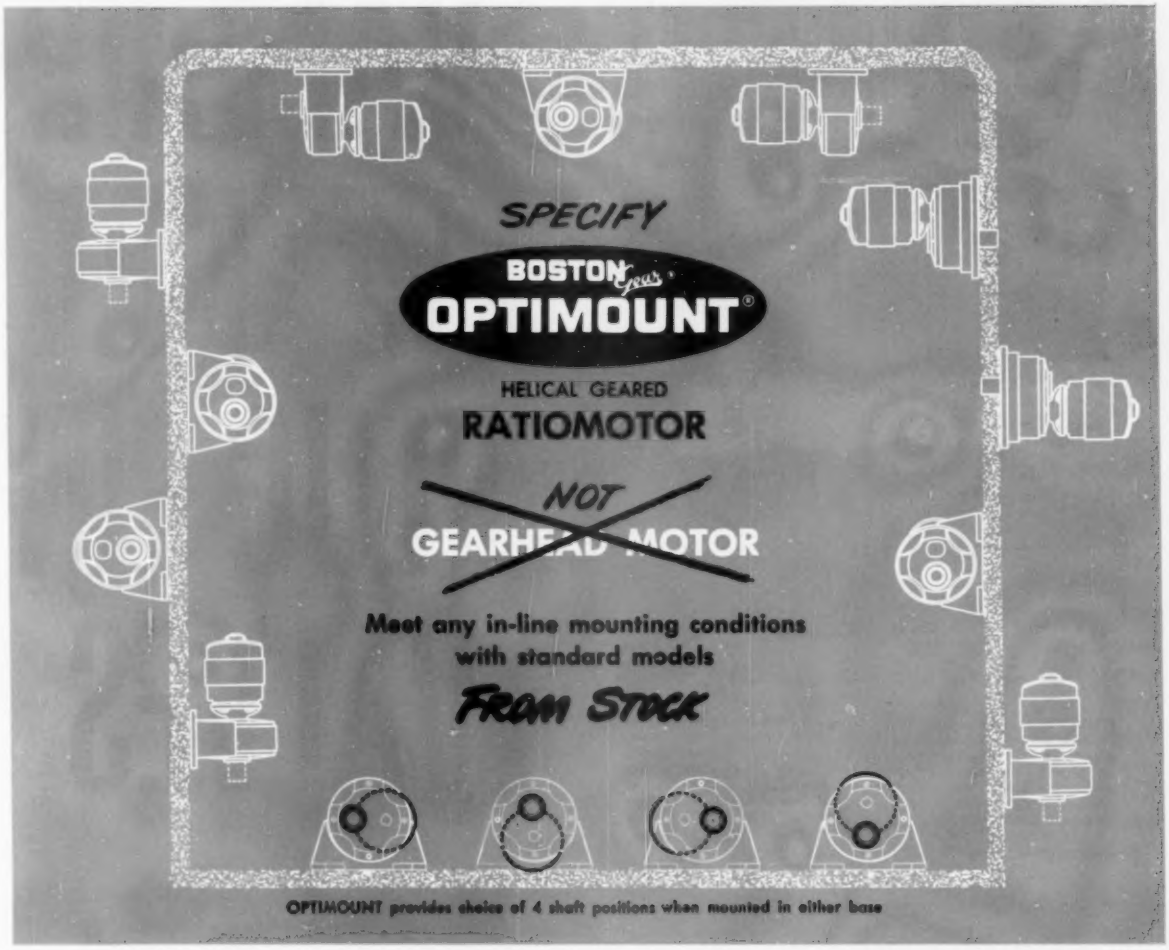
Sacrificing a few pennies of increased tool costs to make dollars in production profits is not a new idea. It has been proven-in-use by many progressive plants, and we will gladly send you records of such operations. These results can be duplicated in other plants where machines and talented operators have been held back by old ideas about tooling and tooling costs.

Ask your Kennametal Carbide Engineer how Kendex* (patented) tooling can help you get more efficient output from *your* machines . . . or write direct for the booklet, "There's Profit in Retiring a Tradition." KENNAMETAL INC., Latrobe, Pennsylvania. 97237

*Trademark

INDUSTRY AND KENNAMETAL ...Partners in Progress

How to keep in-line drives in line with today's cost-reduction demands



OPTIMOUNT Ratiomotor adaptability opens up endless opportunities for highest efficiency in drives once restricted by the mounting limitations of gearhead motors. With OPTIMOUNT optional mounting, you can choose from 456 combinations and get the arrangement you want, ready to install, FROM STOCK.

You can order horizontal or vertical base mounted — with any shaft position needed — for any floor, wall, or ceiling mounting position. Any size you need, with single or double helical gearing, for 1/6 to 10 hp drives. Motor is readily detachable, can be changed in minutes. You can also order OPTIMOUNT without motor, if desired, ready for attachment of motors you have purchased separately.

Get complete information. Ask for Catalog No. 57. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

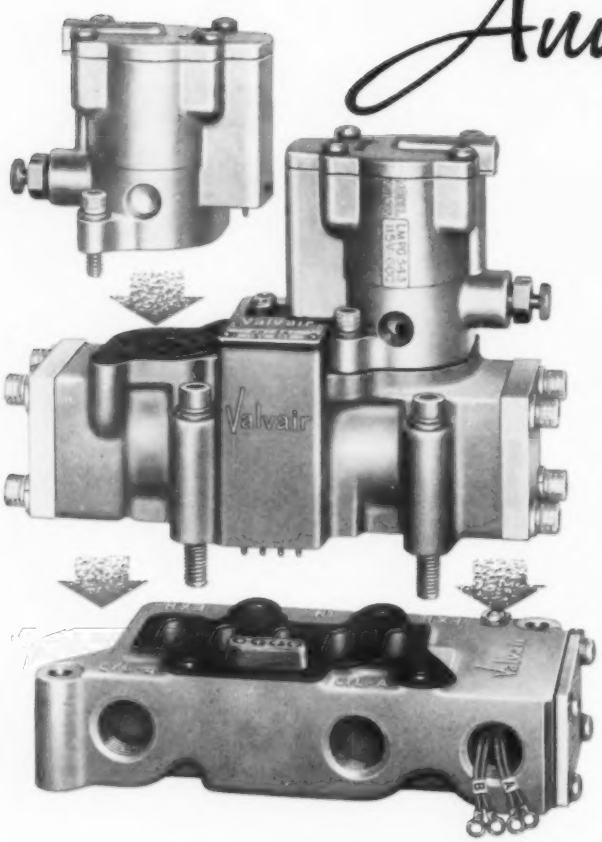
ORDER FROM YOUR LOCAL DISTRIBUTOR
Get OPTIMOUNT arranged as specified, READY TO INSTALL
FROM STOCK!
at factory prices

CALL YOUR NEARBY **BOSTON Gear DISTRIBUTOR**

— *STANDARDIZATION PAYS* —

Announcing

VALVAIR® ½" NPT PLUG-IN VALVES



MODEL PD-441 shown. 4-way single or double pilot-operated types, for sub-base or manifold mounting. Aluminum and stainless steel components assure multi-million cycle dependability. Interchangeable pilots, with coils guaranteed against burn-out for life of valve, fit any plug-in Speed King. Coils for ac or dc, any voltage . . . 35 — 200 psi range . . . integral junction box . . . optional manual over-ride, common or separate exhaust ports, sub-base connected external pilot supply . . . ¾ in. exhaust ports, ½ or ¾ in. inlet and cylinder ports . . . valve meets JIC standards.

Based on the service-proved design principle of the Speed King ¼ in. plug-in Valvair's ½ - ¾ in. plug-in valve series provides plug-in convenience and versatility to a wider range of control valve applications.

Electrical and pneumatic circuits are completed automatically when valve and pilot are plugged in . . . bolted down. The result — cost-cutting reduction of original installation and maintenance time. All power connections are made permanently in sub-base or manifold . . . there's no need to disturb piping or wiring for quick in-service maintenance.

What's more, advanced design shortens stroke . . . speeds response. Separate coded (4-wire) circuits on double solenoid models meet JIC requirements. Flow area through valve and sub-base equals that of full ½ in. pipe.

Whether your control valve applications are on the drawing board or now in service, it'll pay you to investigate the advantages of Valvair plug-in design. A call to your near-by Valvair field office will bring prompt application engineering recommendations.

SEE THEM IN BOOTH 1109 AT THE ASTE TOOL SHOW IN DETROIT, APRIL 21-28.

For more information, write for Bulletin SPL. Address Dept. TE-360, Valvair Corporation, 454 Morgan Ave., Akron 11, Ohio

8098

Valvair AKRON 11, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co. The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.

NEW

Wesson Presents a New Era of Progress with the all-new

WESSON T-A*

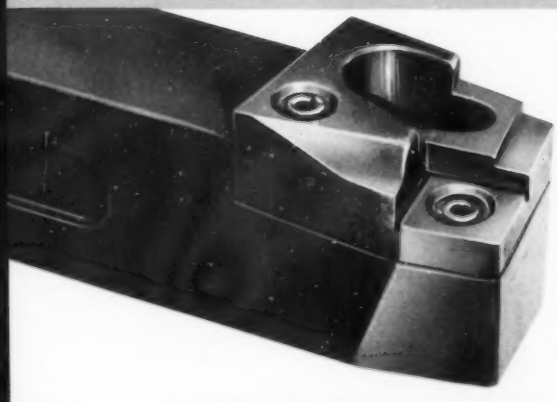
TOOLHOLDER

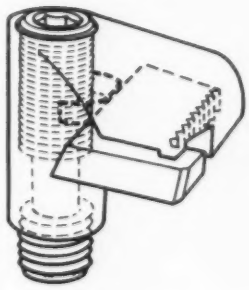
* THROW-AWAY

- *simple to* **USE**
- *simple to* **INDEX**
- *simple to* **STOCK**

Now after two years research and 25 tested prototypes, Wesson brings to industry the all-new Wesson T-A*. Completely new in design, performance and value, the Wesson T-A* simplifies your tooling for throw-aways, saves time, effort and money. It has just two units plus the tip, yet gives full adjustability, within its range, for *any* insert or chipbreaker setting. Tool changes and adjustments are made quickly, easily, regardless of holder position or orientation. Write today for detailed information on the all-new Wesson T-A*.

JUST TWO SIMPLE UNITS





NO. 1 SHANK UNIT—A semi-permanent "assembly" consisting of 4 replaceable parts—shank, anvil-locator with coined seat and two roll pins attaching the anvil to the shank. No adjusting required.

NO. 2 CLAMP UNIT—Its four parts—clamp, compound screw, spring clip and chipbreaker—can't come apart in use or when indexing tips. Stainless steel spring clip retains chipbreaker in any position.

FOR FURTHER INFORMATION CIRCLE READER SERVICE CARD NO. A-1

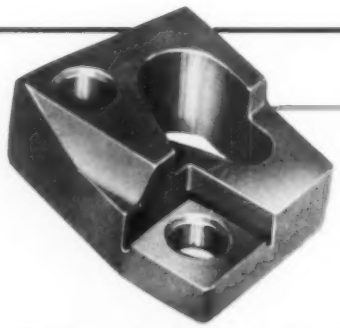
SEE OTHER SIDE

SIMPLICITY MEANS SAVINGS

you handle more jobs with less tooling with the *New* WESSON T-A*

Here's Why:

The new Wesson T-A* has fewer *and simpler* parts. Indexing is fast, sure. Chipbreaker adjustment is easy, positive. One Allen wrench serves any tool. Design permits absolute repeatability of settings.



2 in 1 Anvil-Locator with Flat Anvil Seat

Precision, one-piece investment steel casting for maximum strength and rigidity. Coined seat assures flatness. Zero side overhang permits compact ganging of tools. Designed for 3/16" thick inserts but can also use 1/8" with locked-in shim. Fine detail in holders makes possible use of inserts with radii as small as 1/64". Protects shank, easily replaceable when damaged. New shank purchase unnecessary.

Wide Range, Vise-Jaw Type Clamp Unit

Fast, parallel clamping at all times. No breakage of inserts or chipbreakers when indexing or changing inserts. Complete clamp assembly rides up and down on compound screw. Large clamping range. Set low, set back and relieved so chip will not hit clamp. Can be used without chipbreaker on cast iron, etc. Design prevents incorrect reinsertion if assembly is removed from shank.

Adjustable, Solid Carbide Chipbreaker

Adjustable over wide range, with vertical and visible serrations. Regrindable six times. Supported and spring-locked in channel of clamp yet easily adjusted or removed with fingers. Rides up and down with clamp when indexing, cannot drop out.

* THROW-AWAY

WESSON COMPANY 1220 WOODWARD HEIGHTS BLVD. FERNDALE 20, MICHIGAN

In Canada: **WESSON CUTTING TOOLS, LTD.** 93 Judge Road, Toronto 18, Ontario

FOR FURTHER INFORMATION CIRCLE READER SERVICE CARD NO. A-1

BATH Tap'n Gage TIMES

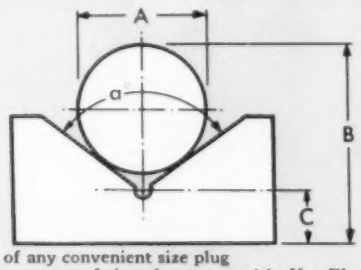
A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 13

Subject: Thread Inspection of Taps with 3, 5 and 7 Flutes (Unified and American)

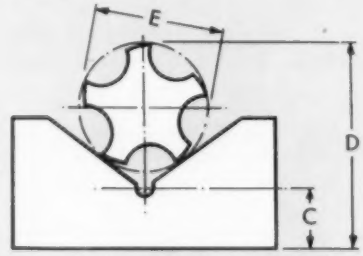
Pitch diameter and major diameter measurement of odd flute taps presents problems not found in checking even flute taps because the flutes are not opposite each other. This inspection plan provides a simple method of measurement so that the actual major and pitch diameters of taps having 3, 5 or 7 flutes may be determined. The so-called size of Vee Block (C) is found as shown by Figure 1. This size should be etched on the block for use in the formulas. The thickness of block is suggested as equal to at least 3 pitches, but not less than 5/16" thick for ease in handling. Complete equipment for this plan consists of precision Vee Blocks, measuring wires and micrometers.

Fig. 1



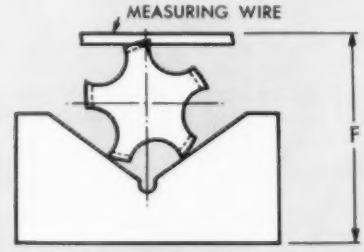
A = Dia. of any convenient size plug
B = Measurement of size plug mounted in Vee Block
C = Size of Vee Block

Fig. 2



D = Measurement of tap mounted in Vee Block with cutting edges in contact with sides of angle
E = Major Dia. of tap

Fig. 3



F = Measurement over Vee Block of tap with a wire inserted in the thread space at the cutting edge

FORMULAS

3 FLUTE TAPS

a° = angle of Vee Block = 60°

1. $C = B - \frac{3A}{2}$ 2. $E = \frac{2(D - C)}{3}$

3. $D = \frac{3E}{2} + C$

4. Pitch Dia. of tap = 2(F − D) + E − *Constant for wire

5. $F = \frac{\text{Pitch Dia. of tap} + \text{*Constant for wire} - E}{2} + D$

5 FLUTE TAPS

a° = angle of Vee Block = 108°

1. $C = B - 1.118A$ 2. $E = \frac{D - C}{1.118}$

3. $D = 1.118\ E + C$

4. Pitch Dia. of tap = 2(F − D) + E − *Constant for wire

5. $F = \frac{\text{Pitch Dia. of tap} + \text{*Constant for wire} - E}{2} + D$

7 FLUTE TAPS

a° = angle of Vee Block = 128° − 34′ − 18″

1. $C = B - \frac{2.1099A}{2}$ 2. $E = \frac{2(D - C)}{2.1099}$

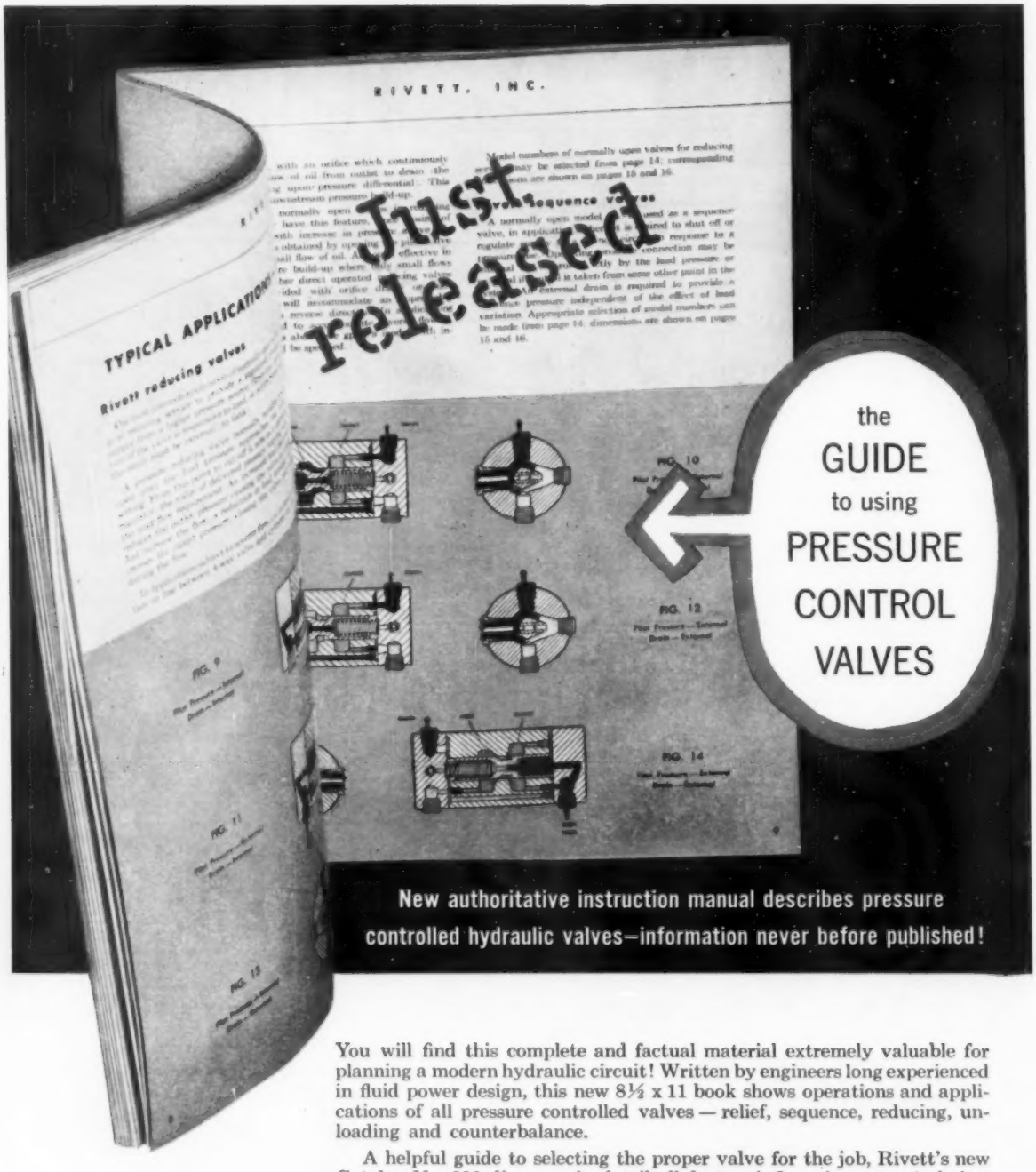
3. $D = \frac{2.1099E}{2} + C$

4. Pitch Dia. of tap = 2(F − D) + E − *Constant for wire

5. $F = \frac{\text{Pitch Dia. of tap} + \text{*Constant for wire} - E}{2} + D$

*The "best size" wire and constant may be found in Bath Catalog No. 55, Page 86, Columns 3 and 4. When "best size" wires are not available, use wires large enough to project above the crest of thread, and small enough not to ride on crest of thread.

Constant = (3x wire diameter)—(single height V-Thread)



You will find this complete and factual material extremely valuable for planning a modern hydraulic circuit! Written by engineers long experienced in fluid power design, this new 8½ x 11 book shows operations and applications of all pressure controlled valves — relief, sequence, reducing, unloading and counterbalance.

A helpful guide to selecting the proper valve for the job, Rivett's new Catalog No. 230 discusses in detail all factors influencing correct choice: normal spool position, operating pressure source, pilot or direct operation. Also shown are flow diagrams, pressure vs. flow curves, ratings, dimensions, drawings and specifications.

For your free copy of Catalog No. 230, write on company letterhead to

RIVETT, INCORPORATED, DEPT. TE 3
Brighton 35, Boston, Massachusetts

RIVETT furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

Member—National Fluid Power Association

***the* complete line** For Butterfield end mills, delivery time is short, service life is long. That's true of all other Butterfield tools: drills, reamers, taps, dies, counterbores, cutters, hobs and carbide tools. Phone for these, or for technical aid. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

BUTTERFIELD

DIVISION, Union Twist Drill Company, Derby Line, Vt.

UNBRAKO...

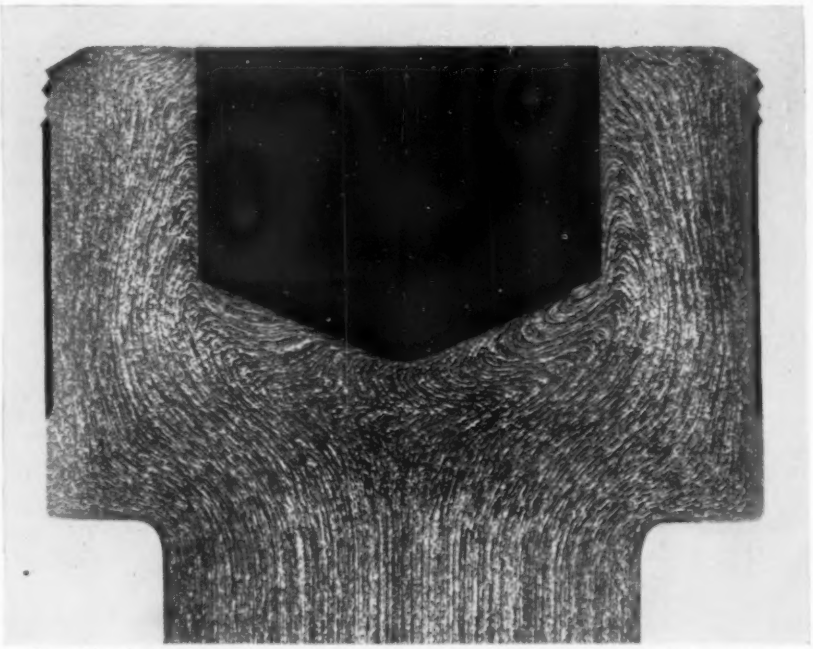
maximum strength in the critical fastener areas to assure minimum downtime

The critical areas? Head, thread, socket, fillet. These are the spawning grounds for fastener failure. So to increase the mechanical reliability of your assemblies, SPS laboratories work ceaselessly on these problem areas.

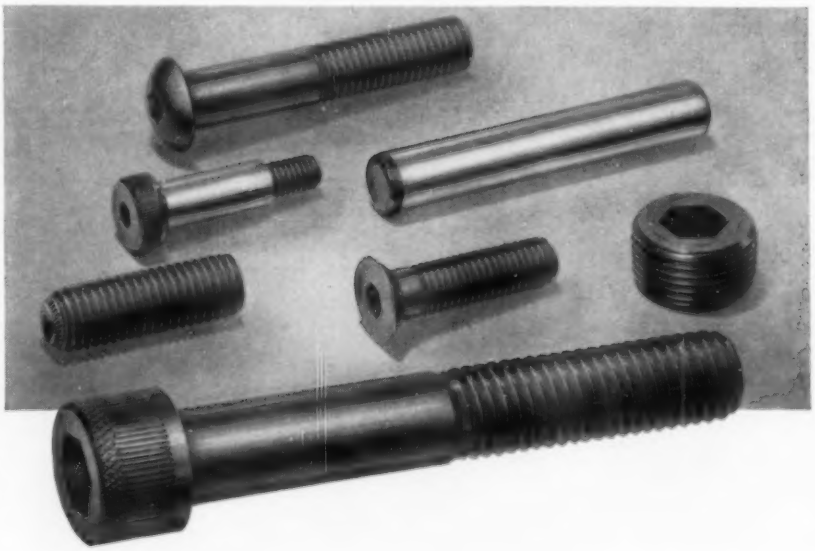
Among recent UNBRAKO advances are the pHd* head and the Hi-Life thread. The pHd head provides up to 2⅓ times as much holding power, the Hi-Life thread up to 100% longer fatigue life.

Other UNBRAKO pluses: a deeper, more accurate socket that assures uniform wrenching power for high maximum torques . . . controlled head-to-shank fillet and forged head for continuous grain flow that increases strength and resistance to fatigue failures . . . Nylok† (available on all UNBRAKO threaded fasteners), which utilizes a tough, resilient nylon pellet fixed in the threaded section of the screw to make UNBRAKOs self-locking . . . the self-locking knurled cup point, which prevents High Torque UNBRAKO socket set screws from working loose even in poorly tapped holes.

Your authorized SPS distributor carries the complete UNBRAKO line. You can depend on him to have on his shelves at all times whatever stock items you may need (and to arrange for extremely quick delivery on others). See him for further information—or write SPS for Bulletin 2338.



Forged head allows fibers of material to follow closely outside contours of screw, thus providing unbroken grain flow for maximum fatigue and shear resistance.



Standard UNBRAKO Screw Products

PRODUCT	DIAMETERS
Socket Head Cap Screws	#0 to 1½ in.
Socket Set Screws	#0 to 1 in.
Flat Head Socket Screws	#0 to ¾ in.
Button Head Socket Screws	#0 to ⅜ in.
Shoulder Screws	⅛ in. to ¾ in.
Dowel Pins	⅛ in. to 1 in.
Pressure Plugs	⅛ in. to 1¼ in.

Stainless steel cap and set screws are stock items. All other UNBRAKO products are available in stainless steel on order.

*pHd stands for "proper head design" (1960 series)—a factor in higher product reliability

†T.M. Reg. U.S. Pat. Off., The Nylok Corporation

INDUSTRIAL FASTENER Division

JENKINTOWN 37, PENNSYLVANIA

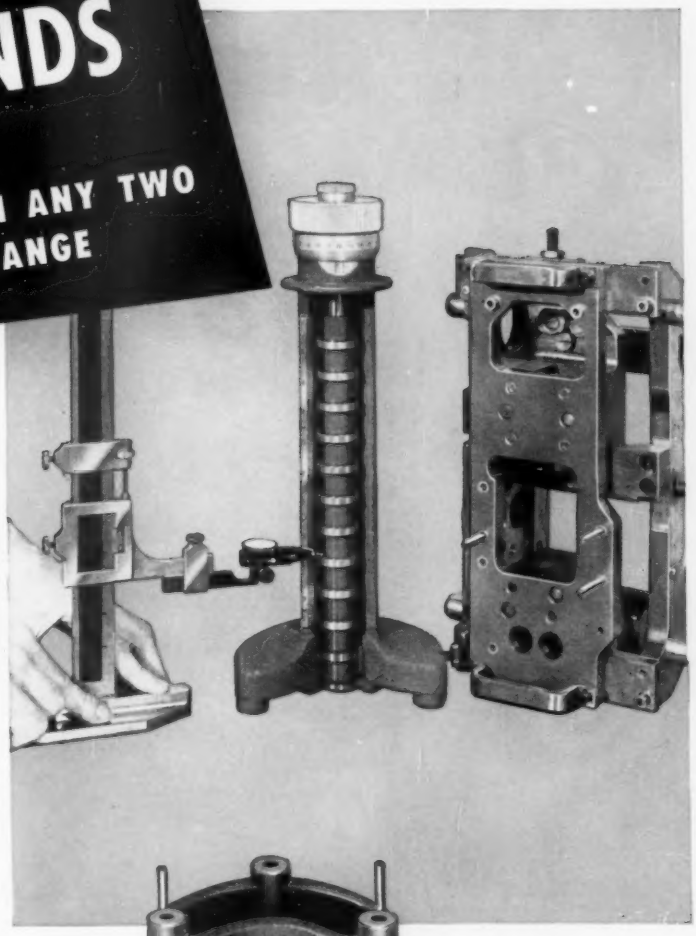
SPS *where reliability replaces probability*

SETTING TIME:

10 SECONDS

ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



Cadillac PLA-CHEK

SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

And, accuracy is assured! Between any 2 points in the 12" range accuracy is guaranteed within .00005".

With a reverse checking plate, a height-gage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used—upping range to 18".

Cadillac

GAGE COMPANY

P. O. BOX 3806 • DETROIT 5, MICHIGAN

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

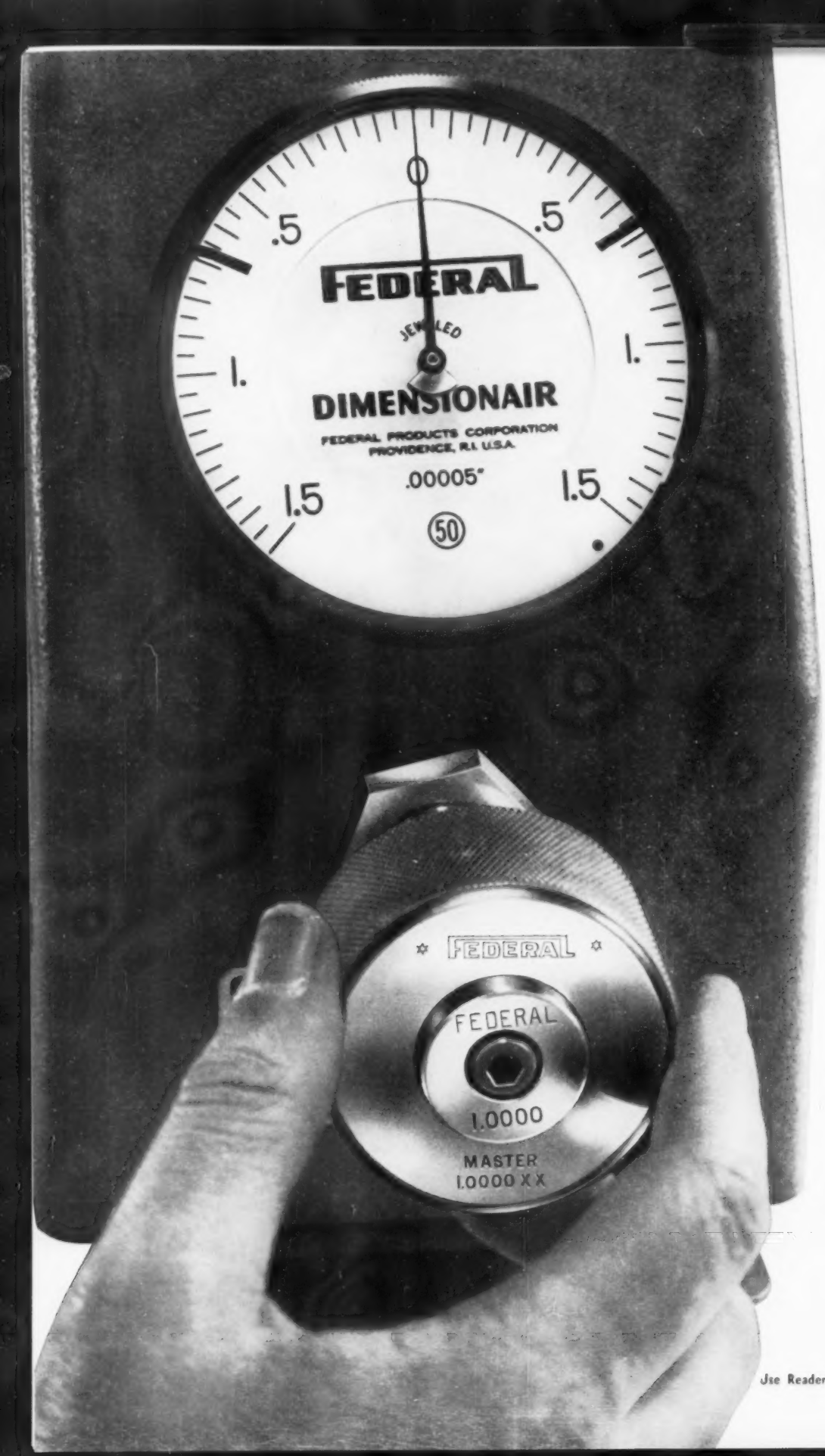
Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

City_____ Zone____ State_____



NO

DOUBT ABOUT IT

. . . that's why the

DIMENSIONAIR

is the best air gage you can buy!

No doubt about the Dimensionair's readings

Such sharply defined calibration — the mark of a truly accurate gage — obviously gives you greater resolution, much finer readings than broadly defined graduations and wide hands or air-suspended markers ever can. Each time you gage with the Dimensionair, the needle-thin indicating hand advances smoothly, comes to a positive stop, yet is responsive to the slightest change. Its position in relation to the fine-line graduations is unmistakable. Such decisiveness, coupled with Dimensionair sensitivity, means much greater readability. In fact, tests prove that you get more information from the Dimensionair than from other air gages having *twice* the magnification.

No doubt that the Dimensionair maintains its accuracy

Dimensionair magnification is built-in . . . fixed. No adjustment can change it. That's why the Dimensionair, once set, *stays* set. Air pressure variations cannot affect the accuracy of the Dimensionair. Its balanced air circuit cancels them out, This achieves a stability which cannot be approached by other air gages.

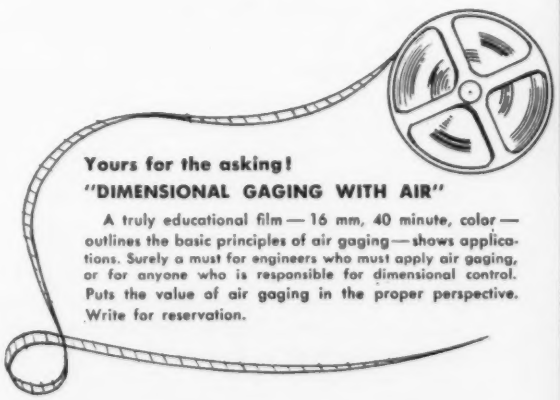
No doubt the Dimensionair is easiest to use

Its fixed magnification and protection against drift guarantees *linear, calibrated* accuracy so you need only *one* master for set up . . . make only *one* adjustment to set zero. You're ready to gage in less than ten seconds! Dimensionair design gives you wide range operation (up to .006″ depending on model selected)*. You also get greater plug clearance and more deeply recessed gaging jets for faster, easier gaging and longer life than is possible with other air gages.

All these advantages are based on the fact that the Dimensionair, unlike other air gages, is *built* to a specific accuracy and magnification. This is an important difference, as thousands of Dimensionair users can tell you. But don't just take our word for it . . . see for yourself. We will be glad to demonstrate the Dimensionair to you, either by itself or against any other air gage. We have offices all over the country. There's a Dimensionair near you, ready to be demonstrated.

FEDERAL PRODUCTS CORPORATION
6193 Eddy Street · Providence 1, R. I.

*FIVE MAGNIFICATIONS TO CHOOSE FROM:
1,250:1 (.006″ range, each grad. = .0001″)
2,500:1 (.003″ range, each grad. = .00005″)
5,000:1 (.0015″ range, each grad. = .00002″)
10,000:1 (.0006″ range, each grad. = .00001″)
20,000:1 (.0003″ range, each grad. = .000005″)



Yours for the asking!
"DIMENSIONAL GAGING WITH AIR"

A truly educational film — 16 mm, 40 minute, color — outlines the basic principles of air gaging — shows applications. Surely a must for engineers who must apply air gaging, or for anyone who is responsible for dimensional control. Puts the value of air gaging in the proper perspective. Write for reservation.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Here's an All New Way to...

cut-trim-punch

CUTTING... Panel Cutter zips through sheets up to 16-gauge. High visibility ahead of cutter edge makes it easy to follow straight or curved lines.

TRIMMING... Edging Chisel trims edges neatly and rapidly. There is no tendency to bend or distort the edge.

PUNCHING... Hole Punch makes perfect size holes for sheet metal screws, in a fraction of the time required for drilling. Extrudes metal at rear of sheet, which affords multiple thread grip for screw.

SAVES TIME... EASY TO USE!

NEW industrial CP-4XR Zip-Gun Kit is a versatile air-operated 9-tool outfit built to save time. It's easy to use and can help raise work quality in industrial plants and sheet metal shops. And five minutes after you try it on any erection job involving metal panels or ducts, the Zip-Gun becomes indispensable. Unskilled operators quickly learn to follow scribed patterns, trim sheets, punch holes for sheet metal screws.

REAL VERSATILITY FOR SHEET METAL WORK!

Shown at right are the 9 special accessory tools included in the CP-4XR Zip-Gun Kit. Gun and tools are packed in a sturdy metal carrying case, with a separate compartment for each tool. Weighs only 12½ pounds.

Cutting tools and punches are made of high grade electric furnace alloy tool steels. Safety, quick-releasing retainer holds them firmly in the Zip-Gun while in use ... makes changes fast and easy.

sheet metal

save time . . . improve quality with the NEW CP-4XR (Air-Operated) ZIP-GUN

Chisel Blank

Flat Chisel

Panel Cutter

Edging Chisel

CP-4XR ZIP-GUN with Quick-Release Safety Retainer and Power Regulator. Weight: Only 3½ pounds.

Hole Punch for #6 Screws

Hole Punch for # 8 Screws

Hole Punch for #10 Screws

Hole Punch for #12 Screws

Hole Punch for #14 Screws

New CP-4XR Zip-Gun Kit. Weighs only 12½ lbs.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS
DIESEL ENGINES • HYDRAULIC TOOLS • VACUUM PUMPS

Chicago Pneumatic Tool Company, Dept. Z-1
8 East 44th Street, New York 17, N. Y.

☐ Please arrange for no-obligation, in-the-shop demonstration of the new industrial Zip-Gun

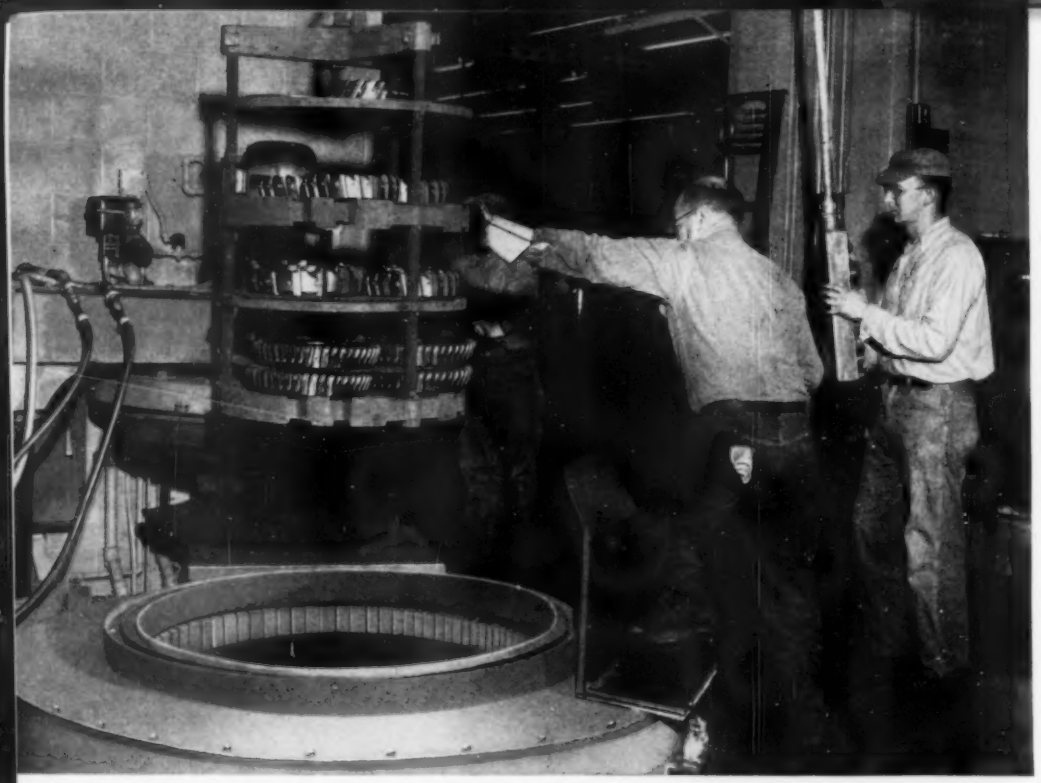
☐ Please send me FREE Bulletin, SP-3243-2 giving details of new CP-4XR Zip-Gun Kit

Name_____

Company_____

Address_____

City_____ Zone____ State_____



This Lindberg Furnace, Model CT3848-A, is being used at Ingersoll Milling Machine Company, Rockford, Illinois, for hardening Ingersoll inserted blade milling cutter bodies and also for gas carburizing. It is equipped with Lindberg's exclusive CORRTHERM electric heating elements. Temperature range 1850° to 2000°F.

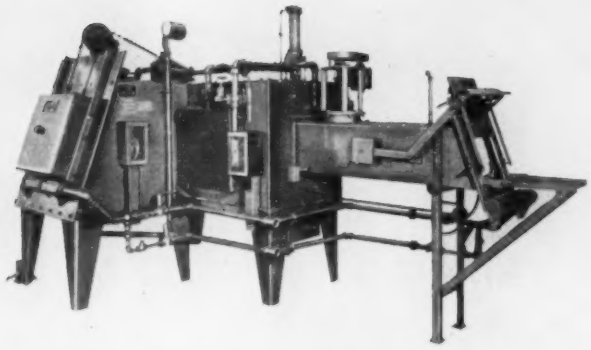
THIS VERSATILE LINDBERG FURNACE BELONGS IN MOST ANY METAL WORKING OPERATION

Heat treating installations across the country, captive or commercial, have found the versatility and dependability of this Lindberg furnace, either electric or fuel fired, a great production asset. Used at Ingersoll for hardening and carburizing, it is also ideal for a variety of heat treating needs including normalizing, annealing and tempering. This furnace occupies little floor space, handles a large volume of production and its rugged construction keeps maintenance costs uniformly low. At Ingersoll, it is one of several Lindberg furnaces in regular operation. Others include pit and box type Lindberg Cyclones and an L-type Furnace. Atmospheres are provided by Lindberg Hyen Generators.

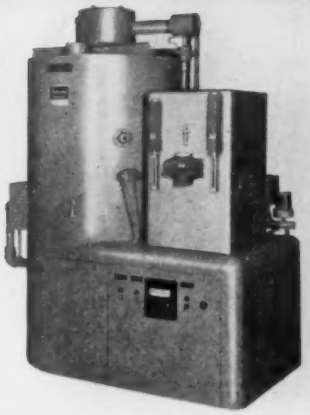
Lindberg has developed a wide variety of equipment for any industrial heat treating requirement. We provide everything from individual furnaces to complete, automated heat treating installations. These can either be factory-built or installed in your own plant. For the most satisfactory answer to any heat treating problem see your local Lindberg field representative (consult your classified phone book) or write direct to Heat Treating Division, Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg, Limited, Toronto.

Fixture being loaded with work while furnace is treating another load. Treated load will be removed and new load inserted quickly and easily.

CORRTHERM heating elements operate at extremely low voltage so heat leakage through carbon saturation is eliminated and shock or short hazard prevented. Makes possible use of electricity for carburizing without furnace retort.

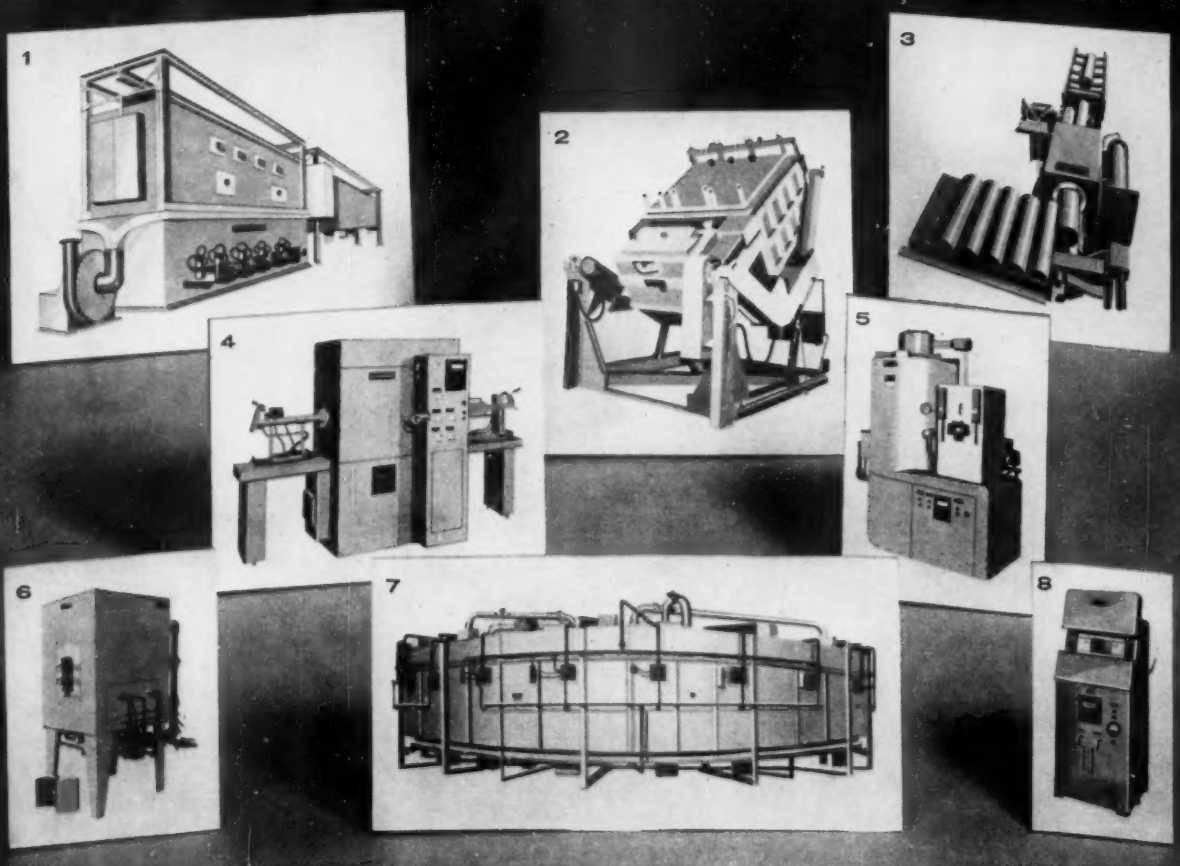


The Lindberg installation at Ingersoll includes one of our L-type Furnaces, ideal for treating high speed steel.



Atmospheres for Lindberg furnaces at Ingersoll are provided by Lindberg's Hyen Generator, a fully automatic process for producing endothermic atmospheres.

THERE'S LINDBERG EQUIPMENT FOR EVERY INDUSTRIAL HEATING NEED



1 **Salt Bath Furnaces:** Complete line of Lindberg-Upton equipment for all types of salt bath treatment. Shown: Installation for aluminum dip brazing.

2 **Melting and Holding Furnaces:** Equipment for any non-ferrous metal requirement including electric resistance and induction reverberatories, crucible and two chamber induction units. Shown: 350 KW Induction Furnace with 30,000 lb. capacity.

3 **High Frequency Units:** Complete range of induction heating units and fixtures. Shown: New Induction Billet Heater for aluminum extrusions.

4 **Pilot Plant Equipment:** Complete group of intermediate sized furnaces for pilot plant and small production application. Shown: New Graphite Tube Furnace, temperature range 2500°F. to 5000°F.

5 **Atmosphere Generators:** Generators for all required furnace atmospheres. Shown: Hyen Generator for endothermic atmospheres.

6 **Ceramic Kilns:** All types of kilns: automatic, atmosphere controlled, high temperature, tunnel and periodics. Shown: Periodic Kiln, temperature range to 3250°F.

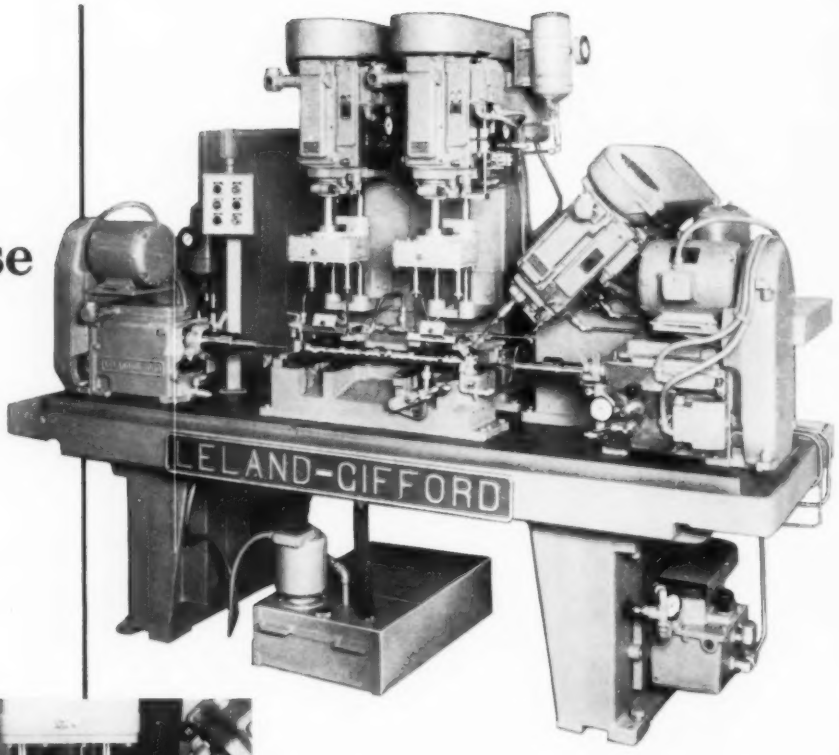
7 **Heat Treating Furnaces:** For every requirement, large or small, electric or fuel fired, factory built or field-installed. Shown: Rotary Hearth Furnace field-installed by Lindberg Industrial Division.

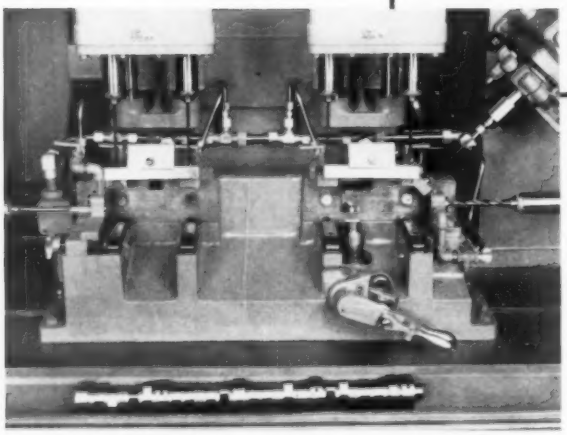
8 **Laboratory Furnaces:** Complete line of laboratory furnaces from simple hot plates to specialized research units. Shown: Versatile, wide temperature range Laboratory Box Furnace.

For full information on any type of Lindberg equipment see your local Lindberg field representative (look in your classified phone book) or write to Lindberg Engineering Company, 2447 W. Hubbard Street, Chicago 12, Illinois.

LINDBERG heat for industry

Here's an idea you can use to cut precision drilling costs....





One machine, one handling, one quick, simple operation does all the precision drilling on this camshaft. Note that this is not ordinary gang drilling — the job involves axial, angular and cross holes as well as reaming.

Leland-Gifford has time-saving, cost-cutting ideas for you, too — ways you can combine multiple operations into a simple, efficient unit operation.

THE JOB: Drill one end of camshaft and ream the other while drilling four cross holes and one angular oil hole.

THE MACHINE: A Leland-Gifford special with five No. 2 self-contained units and standard hydraulically clamped fixture interlocked with drilling units to start feed after clamping and to unclamp when operation is finished. SC units are interlocked to prevent interference between cross and axial drills. One operator completes 60 camshafts per hour at 100% efficiency.

For Automatic Drilling at its best be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

LELAND-GIFFORD SPECIAL DRILLING MACHINES

WORCESTER 1, MASSACHUSETTS
U. S. A.

Chicago 5
2515 W. Peterson Ave.

Detroit
10429 W. McNichols Rd.

Cleveland 22
P. O. Box 853

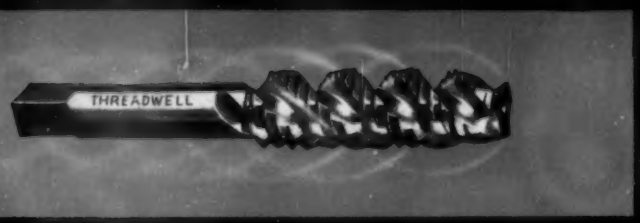
New York Office
75 S. Orange Ave
South Orange, N.J.

Los Angeles Office
2620 Leonis Blvd.
Vernon 58, Cal.

Indianapolis 6, P. O. Box 1051

Rochester 12, P. O. Box 24, Charlotte Station

Only TURBO-CUT by Threadwell has a full 3-4 thread plug chamfer!



Benefit? Turbo-Cut's longer chamfer distributes the load over more teeth and breaks up chips to minimize tap breakage. Turbo-Cut's longer chamfer makes tapping easier and cleaner on through holes, does a one-pass job on blind holes. Only Threadwell makes the genuine Turbo-Cut with the longer chamfer.
Also available in bottoming chamfer.

Threadwell
MAKES THE BEST PRODUCT BETTER

INDUSTRIAL DISTRIBUTORS
SERVING INDUSTRY COMMERCE
THE RIGHT HAND OF PRODUCTION

THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.

FOR THAT EXTRA EDGE IN PRODUCTION!

3½ TIMES MORE END MILL PRODUCTION with the New B&S Thriftmill® in Competitive Shop Tests!

20% Lower Initial Cost, Superior Microfinish and Less Downtime also Proved using new B&S Thriftmill.®

TEST DATA

MATERIAL:

MATERIAL: A1S1-D3 oil hardening tool steel. Hardness, Rockwell C-18.

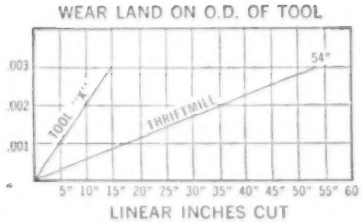
BOTH END MILLS

½" Dia., 4 flute.

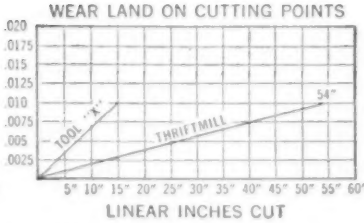
CUTTING DATA

	RPM	SFM	CHIP LOAD	TABLE FEED	DEPTH CUT	WIDTH CUT	LENGTH CUT
B&S Thriftmill®	325	43	.00125	1⅝"	¼"	½"	**54"**
BRAND "X" End Mill	325	43	.00125	1⅜"	¼"	½"	**15"**

WEAR LAND ON O.D. OF TOOL



WEAR LAND ON CUTTING POINTS



MICROFINISH AFTER TESTS

B&S Thriftmill, bottom of slots, RMS 35.

B&S Thriftmill, sides of slots, RMS 30-38.

BRAND "X" End Mill, bottom of slots, RMS 70-100.

BRAND "X" End Mill, sides of slots, RMS 40-60.

The initial economy of the new B&S Thriftmill, together with the proven production benefits engineered into this fine tool, gives a competitive advantage to all B&S Thriftmill users.

There are 1065 different "standard" off-the-shelf B&S end mills to choose from. End wonder, worry and wait—take advantage of B&S tooling superiority and speedy service—call your B&S Distributor now.

Send for "Condensalog" to: Cutting Tool Division, Brown & Sharpe Mfg., Co., Providence 1, R. I.

Brown & Sharpe
HIGH SPEED STEEL CUTTING TOOLS

NELCO
CARBIDE CUTTING TOOLS

Use Reader Service Card, CIRCLE 64

A Milestone

What a thrill to receive the news that we are now officially the American Society of Tool and Manufacturing Engineers, ASTME.

You are to be congratulated on your part in this action for you have turned in a 47 percent response, indicating a final tally of 7½ to 1 in favor of the expansion of the name. To our knowledge this is the highest response to any referendum ballot in ASTME history and, of course, the affirmative approval by a wide majority further proves the need for the change.

As we have grown since 1932, thousands of manufacturing engineers have joined this society for the purpose of benefiting themselves and industry. We are indeed proud and happy to acknowledge this recognition and wish to let it be known to company managements that, in keeping with past practice, our fraternity will advance with the times.

Isn't it true that technical progress developed and employed by ASTME members is responsible to a great extent for the change in the times?

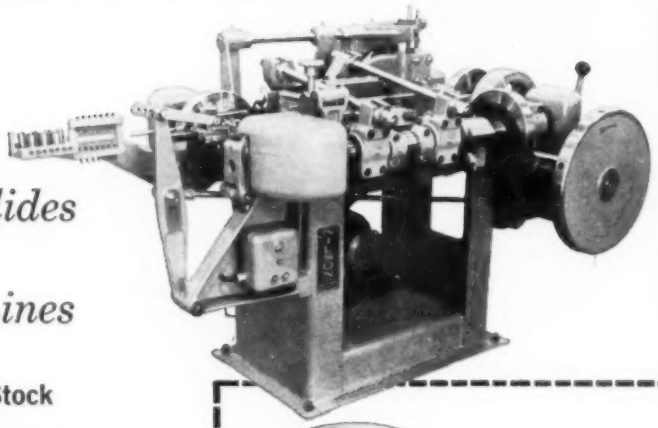
While you are in the office of the boss—chief manufacturing engineer, manufacturing manager, or vice president in charge of manufacturing—apprising him of the recent expansion, please tell him during April 21 through 28 ASTME will stage what can truly be called the "Greatest Show on Earth" as we have come to know tool shows. If you are the boss remind your staff of the importance of attending this show. The News section in THE TOOL ENGINEER explains the activity in detail.

Whether in the pages of our magazine, or at the Tool Show, we display the latest in equipment and methods. He who does not take advantage of this ensemble is not currently informed.

ASTME congratulations!

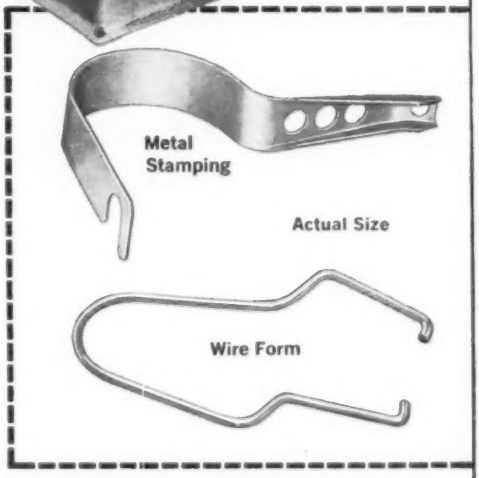
PRESIDENT
American Society of Tool and Manufacturing Engineers

4 reasons why



Nilson Automatic 4-Slides are "Universal" Forming Machines

1. **Form Wire or Ribbon Metal Stock**
2. **Accommodate Long or Short Pieces**
3. **Job Versatility through Quick-Change Cams**
4. **Combine Stamping & Forming in 1 Machine**



Every Nilson Automatic 4-Slide is truly a "universal" forming machine, a machine designed to produce either wire forms or metal stampings at high production rates.

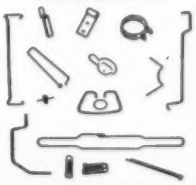
Open construction provides easy access to all tooling . . . permits rapid changeover from one stock to the other. And longer feeds, longer slide strokes give a Nilson the built-in ability to handle a wide range of work sizes — without special attachments or accessories.

17 Models of Nilson 4-Slides to Choose From

Just pick the capacity you need for real efficiency in your pressroom! One of these versatile machines will make your stamping and forming operations faster, easier . . . and more profitable.

Write today for the Nilson General Catalog on Automatic 4-Slide Equipment

SIZE RANGES:
Wire up to ½" diameter
Ribbon stock to 3½" wide
Feeds up to 32"
5 TO 75 TON
PRESS SECTIONS



NILSON
THE A. H. NILSON MACHINE CO.
623 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

INDUSTRIAL COMMUNICATIONS

. . . an engineering approach

Management is responsible for setting objectives and for seeing that they are carried out. Successful managers are able to communicate effectively. Using a man-machine analogy, the author shows how successful communications (input) can lead to greater employee response (output). Improved productivity and better morale result.

By James H. Greene*
Associate Professor
Industrial Engineering Dept.
Purdue University
Lafayette, Ind.

MANAGEMENT TODAY is more dependent on effective communications than at any time in history. The phrase "If you wish a job well done, do it yourself" does not apply to today's complex industrial society, which is based on teamwork.

The purpose of communications is to make people comply in a specified way. In a manufacturing plant, for example, management has the responsibility of seeing that production schedules are met and that products are of the required quality. Achieving these objectives requires good communications between all levels of management and between management and production workers.

The Communications System: Many engineers have difficulty in communicating their ideas and getting them acted upon. Industrial communications, however, are analogous to servo systems that are well within the province of the average engineer. Servo control systems have two features: amplification and feedback. Communication systems in industry include the same features. A request (input) is "amplified" when people act on it and a check of the results (output) provides feedback.

The field of manufacturing management is sometimes regarded as unscientific because there is no means of measuring the inputs and outputs of the "man system" under all conditions. Given specific inputs, there is no way of accurately predicting what the output will be. When an employee is asked to

* Senior member ASTME Kokomo chapter.

do something, the request is only one of several inputs that influence him. Secondary inputs include forces exerted by his union, his fellow workers, his family and society at large.

There is a certain similarity between servo response and human response. When the input to a system and the output of a system are constant, the system is said to be in a steady state or "static." When a system receives a new input it generally takes time for the system to achieve a new permanent condition or steady state. During this time the system is said to be in a "transient" condition. If workers respond slowly to a new input—if they are slow in reaching the expected output—manufacturing costs go up. Similarly, workers can "overcompensate" by responding too quickly. An example is attempting to perform a new job at high rates of speed without thoroughly learning the job first. Production of scrap can result.

The concept of a servo model is not far removed from the organization of many manufacturing plants. Input is represented by an order for a product. The expected output is the product itself. Information that affects the output feeds back to the input. Examples are a machine breakdown, defective materials or other factors that affect the output. The input is adjusted accordingly.

The communications system in industry is usually complex. Blueprints, procedure manuals, office memos, production orders, and time and quality standards are just a few examples of inputs in manufacturing plants. Feedback can take the form of time cards, quality control reports, machine downtime reports and many other communications set up on a formal basis. There is also informal feedback in the form of complaints, suggestions, labor grievances and so on.

Not all communication is written. People communicate not only by what they say but by what they are. Some high school football coaches, for example, communicate by their demeanors—rather than by formal lectures—that they expect each team member to play a clean game and to put forth maximum effort. In manufacturing plants, the best foremen use this unwritten, unspoken method of communication. Some men have this quality; others do not and probably cannot acquire it.

Principles of Communication: There are a number of sound rules that lead to improved communications. The objective of these rules is to make people comply. The rules can be summarized as:

1. *Use Clear Language.* Use language that is familiar to the person you are dealing with. If he does not understand the terms you are using, he will set up a psychological barrier that will always make it difficult to communicate. Remember that your job is to get something done, so use words, pictures, cartoons, mathematical symbols or whatever is needed to get the job done.

2. *Keep Noise to a Minimum.* The term "noise" refers to static in communications, but in everyday plant communications it means "Don't cloud the issue." Leave out all extraneous material. When you are through communicating let there be no question about what it is you want done.

3. *Use Analogies.* Start with experiences or ideas that are familiar to the person you are talking to and carry on from there.

4. *Use Proper Lines of Transmission.* As a communicator, you have to decide what line of transmission to follow. If only one person is involved the best thing to do is communicate directly with this person. More often there are a number of people involved and they all must get the message. Too often, this is a source of trouble. The sender must understand the necessity for the message to radiate out to a number of people. It isn't an individual's compliance, but group compliance, that is often needed.

5. *Use Uniformity in Your Message.* Always ask for the same types of output in the same way. This helps to eliminate confusion.

6. *Use Redundancy.* Don't expect a person to get your message the first time. Communications are never 100 percent efficient. Repeat and repeat. Try feedback to see if your message is being received correctly.

7. *Use Comparisons.* You don't know where you are unless you know where you started. The fact that an employee is turning out twenty more parts an hour doesn't mean a thing unless it is known whether he started the job making 10 parts an hour or 20,000 parts an hour.

8. *Explain Inconsistencies.* If the communication you want a person to comply with is inconsistent with other communications you had better point out the reason—or you won't get the desired compliance.

9. *Give the Details.* Don't leave voids in the message that require guesswork on the part of the recipient. Give the whole message, but remember that unimportant details cause noise.

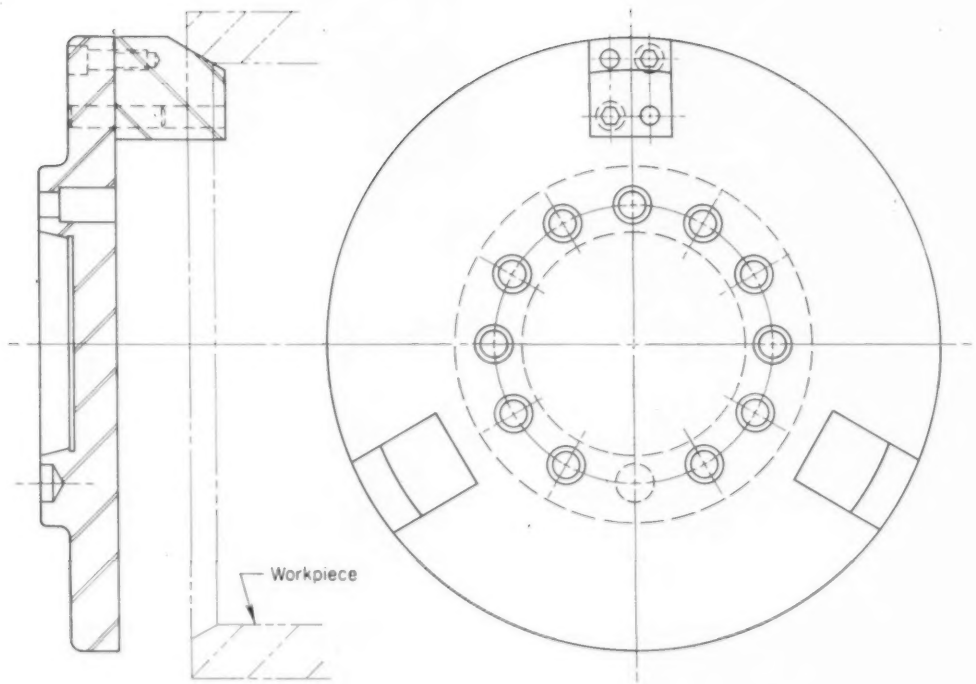
10. *Proper Timing.* Be sure that your message is sent—and received—at the proper time.

With this servo model in mind and a full awareness of the effect of outside influences on its stability, you will be in a far better position to design your industrial communications. Remember that only with feedback can you find out whether or not your communications are good or bad.

While communications are still an art, rather than a science, engineers can do much to put communications on a scientific basis. Observing the ten rules of good communications results in an input that is understandable and effective, leading to consistent output. And that is the desired goal.

Gadgets

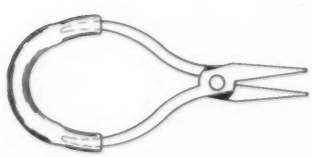
Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work



Special Center

At times it is necessary to provide a large bull center at the headstock end of a lathe. An extremely large special center of this type cannot be purchased as a standard item. Consequently, some fabricated type must be provided. A big solid center is cumbersome and expensive to make. Illustrated is a simply constructed center that will hold accuracy and yet will afford the rigidity necessary for large work of this type. The body of the center is a standard adapter type face plate. Three equally space hardened and ground blocks are screwed and doweled directly to the face plate adapter. The 60-deg centering angle is ground on the machine after the face plate has been bolted to the spindle nose. Because the center is secured directly to the spindle nose, there is very little overhang. The result is a good sturdy center that will stand up under heavy cuts without chattering.

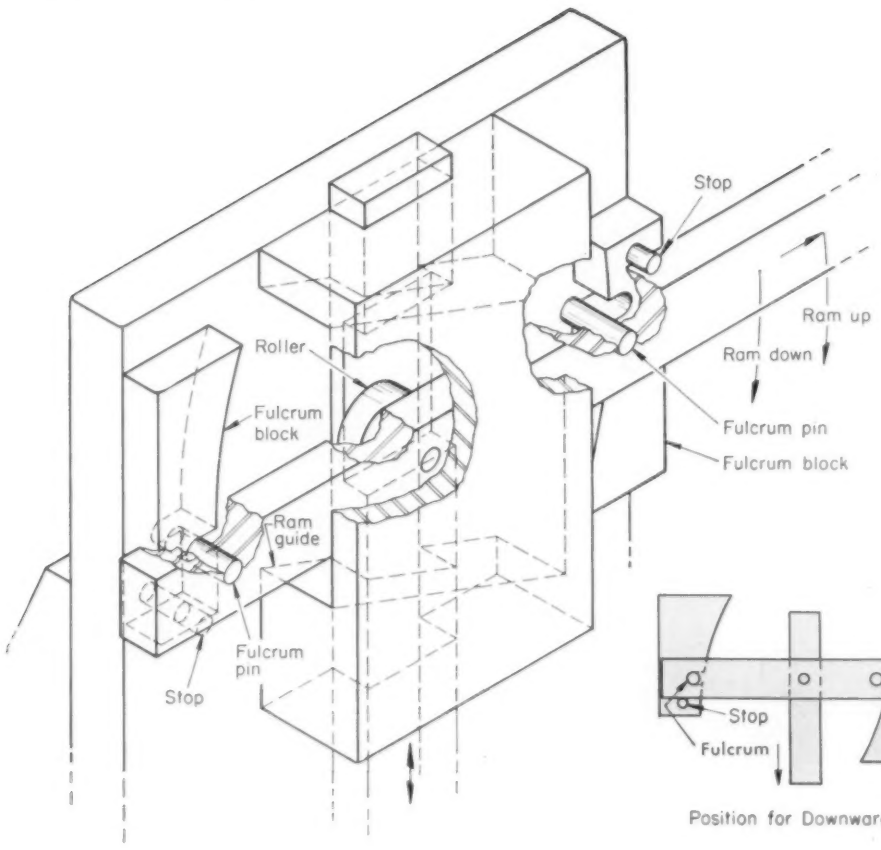
Roger Isetts
Kenosha, Wis.



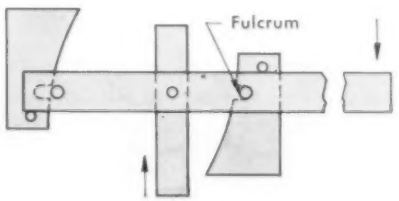
Plier Holding Method

Often in assembly operations it is desirable to provide a method for holding pliers open when not in use. If a spring is used, drilling, tapping or otherwise altering the pliers is generally required. By using a short piece of rubber tubing as shown, the pliers are held open when not in use and may be restored to their original form by simply removing the tubing. No alteration is required.

F. Murray
Chicago, Ill.



Position for Downward Ram Stroke



Position for Upward Ram Stroke

Twin-Fulcrum Lever

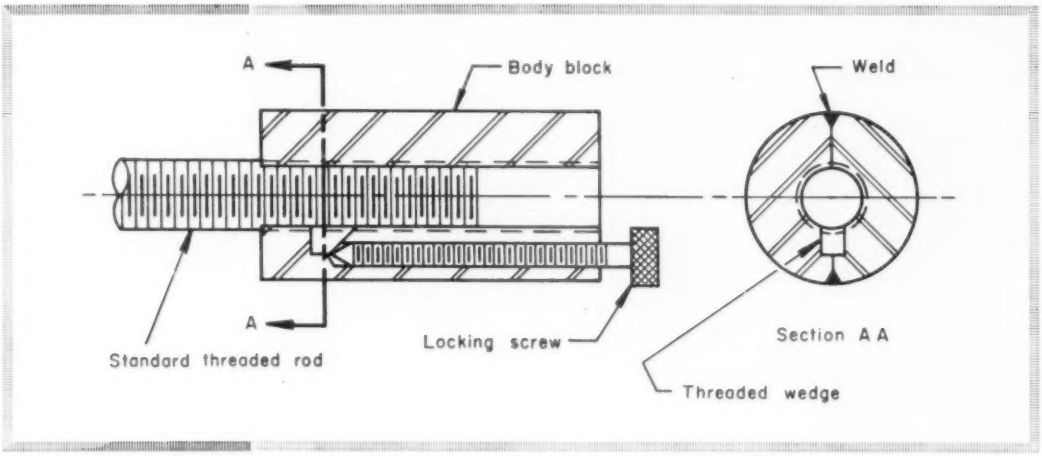
In certain types of gage and fixture work, it is sometimes necessary to apply motion in opposite directions with a considerable amount of force. Although this force is usually reduced for the operator through the mechanical advantage of a lever, such an advantage is not fully realized if the operator must still use one lifting stroke with his arm extended in front of him. The average operator's muscles are not conditioned for this particular effort and fatigue may set in very rapidly.

The lever illustrated is designed with a shifting fulcrum so that both the downward and upward motions of the ram are accomplished with downward pressure on the lever. With the lever in the position shown, a fulcrum pin is engaged in a slot in the fulcrum block to serve as the fulcrum for imparting downward motion to the ram by means of the roller when the lever is moved downward. To raise the ram to its original position, the lever is first returned to the position shown. Manipulating the lever out and down will then cause the other fulcrum pin to nest in its block to serve as fulcrum while disengaging the first pin and block, thus permitting roller to raise the ram as desired. Pins serve as stops when the lever is returned to the horizontal position.

Width of the roller slot in the ram is equal to the roller diameter plus the ram travel required. Distance between fulcrum pins is calculated to give the lever clearance slot a functionally desirable angle. The inner surface of each fulcrum block is an arc generated from the opposite fulcrum point and serves to prevent the opposite fulcrum pin from becoming disengaged during its cycle of use.

Allen M. Johnson
Springfield, Mass. Chapter

Gadgets



Adjustable Stop

Frequent machine setups can be speeded with the adjustable stop illustrated. Replacing jam nuts and obviating the use of wrenches, the stop can be set for fine adjustments quickly. The stop is constructed of two half-round pieces that are welded together so that the pocket for the wedge can be milled out easily. The small wedge is made with stock allowance for threading and inserted in the body tapped body block. A tap is run through the pretapped body block, finishing the wedge.

John M. Breen
Pittsburgh Chapter

Announcing

Gadgets Contest Awards

Following is a list of the winners of THE TOOL ENGINEER Gadgets Contest. The National Editorial Committee and the editors wish to thank the many ASTE members who participated in the contest. Many of the entries will appear in forthcoming issues of THE TOOL ENGINEER.

• **FIRST PRIZE ($100.00)**

Edward D. Bennett	Northern New Jersey

• **SECOND PRIZES ($50.00)**

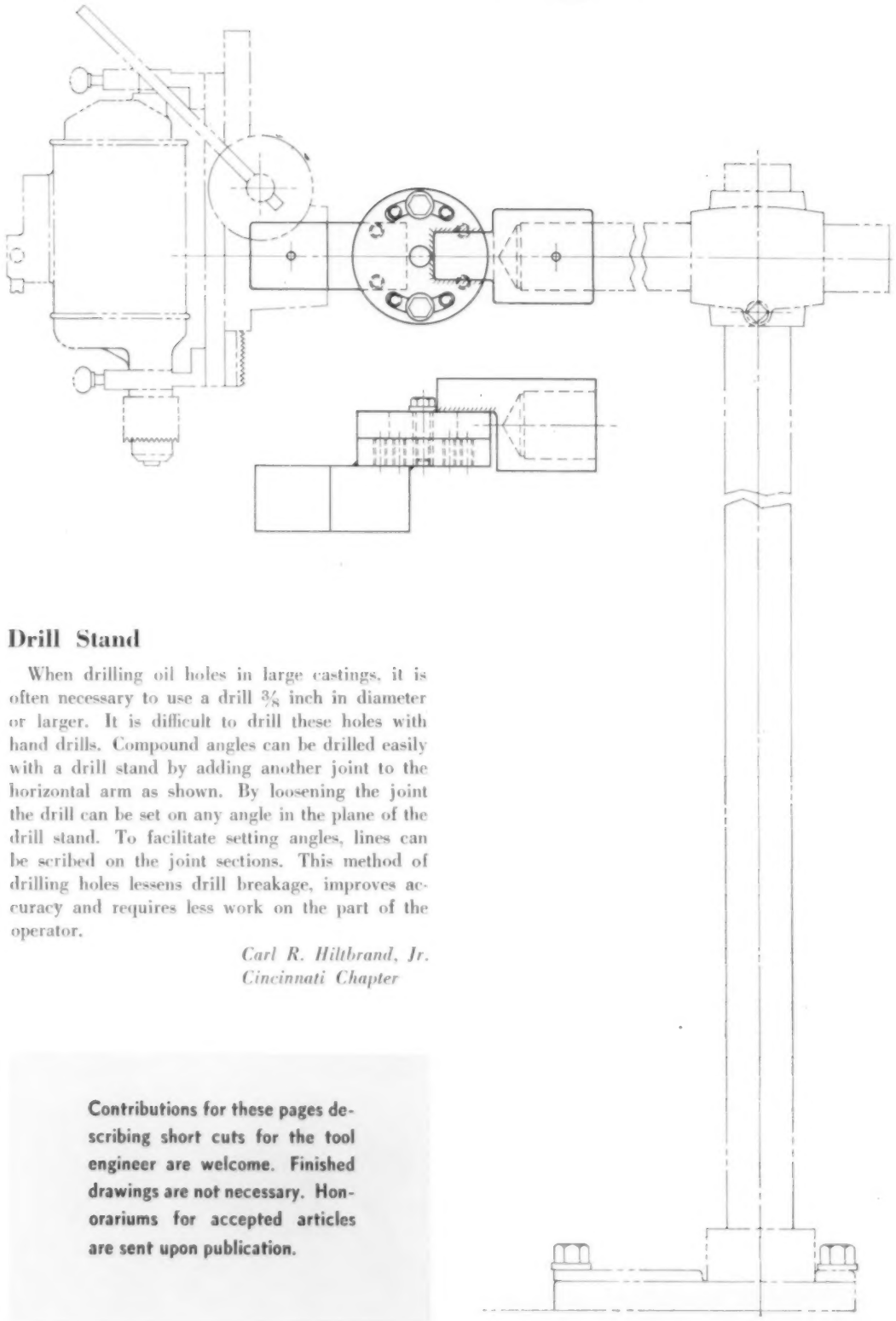
Fred J. Schneider	Lehigh Valley
H. J. Gerber	Member at Large

• **THIRD PRIZES ($25.00)**

Allen M. Johnson	Springfield (Mass.)
G. A. Kendrick	Sydney (Australia)
Vernon E. Springer	Peoria
A. G. Grant	London-St. Thomas

• **HONORABLE MENTION**

Francis E. Baskett	Evansville	**William S. Mazar**	Binghamton
Robert M. Dickson	Springfield	**Robert E. Daly**	San Fernando Valley
		H. Perina	Chicago



Drill Stand

When drilling oil holes in large castings, it is often necessary to use a drill 3/8 inch in diameter or larger. It is difficult to drill these holes with hand drills. Compound angles can be drilled easily with a drill stand by adding another joint to the horizontal arm as shown. By loosening the joint the drill can be set on any angle in the plane of the drill stand. To facilitate setting angles, lines can be scribed on the joint sections. This method of drilling holes lessens drill breakage, improves accuracy and requires less work on the part of the operator.

Carl R. Hiltbrand, Jr.
Cincinnati Chapter

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.

Fig. 1. Bulging a metal cylinder with an underwater spark discharge. Flash at the top of photo is arc at discharge switch.

HYDROSPARK FORMING shapes space-age metals

Discharge of an electric spark under water produces a shock wave with energy sufficient to form metal parts. This article describes an actual application of the process. The article following this discussion outlines theory and development of hydrospark forming.

By J. Frederick Parr
Associate Editor

FORMING many Space Age metals requires enormous amounts of highly concentrated energy to provide the necessary force and desired rates of deformation. Use of explosives to provide energy to form these metals has become a production reality. Hydrospark or "electrohydraulic forming," akin to explosive forming, is now commanding attention.

This forming process utilizes energy created by an electrical spark, rather than explosives, to provide energy. The spark is discharged in a nonconducting liquid medium. A shock wave traveling at the speed of sound emanates from the spark to deform a metal part, *Fig.* 1.

At Republic Aviation Corp. this principle is being applied with development-scale apparatus to produce a rate of force propagation equal to 6000 hp within 40 millionths of a second. Equipment consists basically of a high voltage power supply, capacitors for storing the charge, a discharge switch and a coaxial electrode, *Fig.* 2.

Since the shock wave is emitted from essentially a point source, initial experiments involved free-

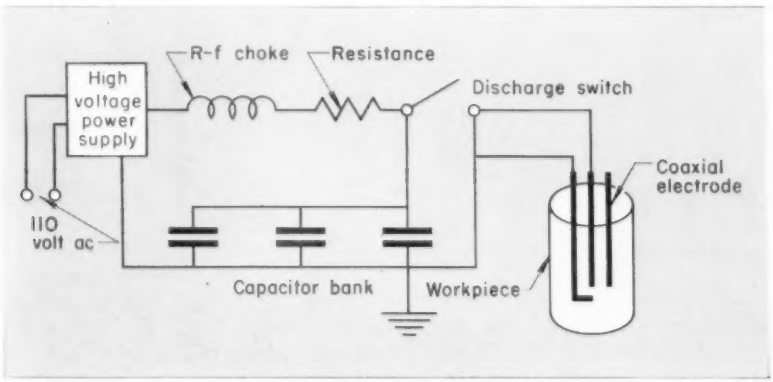


Fig. 2. Schematic of apparatus to produce electrohydraulic bulging of metal cylinders.

Fig. 3. Aluminum cylinders free formed by the electrohydraulic method at voltages from 7500 to 22,500 v. Size of cylinders is 1¼ inches in diameter by 2 inches long with 0.035-inch wall. Part shown at bottom of photo ruptured at highest voltage.

Fig. 4. Part formed in a die by hydrospark method.

form bulging of thin-walled cylinders. By varying the voltage, deformation ranging from slight up to part destruction can be made to occur, *Fig.* 3. Both steel and aluminum have been free formed in this manner. By restraining the part with a die a specific contour can be developed, *Figs.* 4 and 5. This work has now been extended to sheet-metal forming.

Effects of Variables: Precise control of the process can be exercised by strict attention to variables and their combinations. Voltage, for instance, with all other variables constant determines total work. Energy increases as the square of the voltage. The value of voltage to begin deformation must, of course, provide enough force to exceed the yield point of the metal being worked.

Liquids other than water have been used for the shock wave medium but none has been found with clear-cut advantages over it. Other factors affecting forming results are the distance from the spark to the work, size of spark gap, wall thickness of work and the type and mechanical properties of the material processed. All must be carefully coordinated to produce the desired result.

Advantages over conventional blasting materials used for explosive forming are greater safety in handling and ability to maintain more precise control over energy created. Republic engineers are working toward eventual development of the device as a standard machine tool. It is estimated that such a tool could be constructed at about one-tenth the cost of a conventional hydraulic press and occupy only a fraction of the floor space.

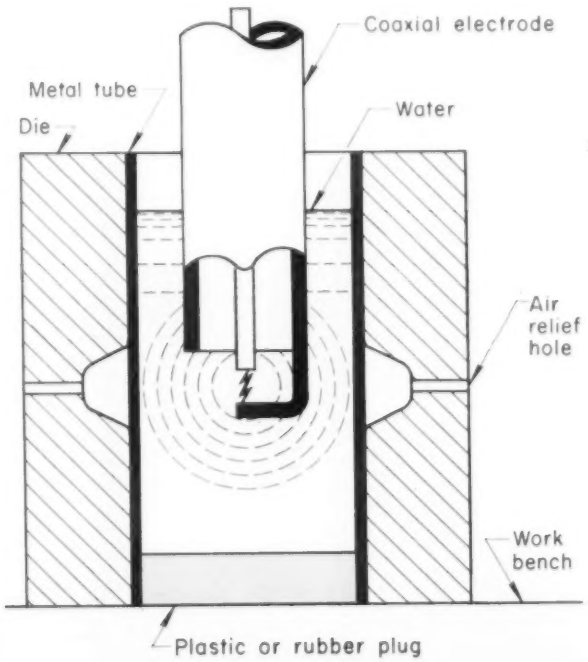


Fig. 5. (right) Die-forming set-up to produce part in *Fig.* 4.

HYDROSPARK FORMING
. . . evolution of the process

By H. J. Wagner
Principal Engineer
and
J. G. Dunleavy
Alloy Development Div.
Battelle Memorial Inst.
Columbus, Ohio

Recent successful applications of explosive forming have stimulated interest in a related process—hydrospark forming. This article traces the development of the process and discusses applications.

ELECTRICAL DISCHARGES have been utilized to a limited extent in metalworking for over a half century. In 1905, for example, Svedberg produced colloidal metal suspensions by means of a condenser discharge in a liquid.[1] This application did not require high voltages.

When a condenser is electrically charged so as to possess a potential difference in the order of several kilovolts, the sudden discharge of the condenser across a spark gap produces a single pressure pulse, or sound wave, that propagates radially from the line of action of the spark. The high rate of propagation of this wave, initially exceeding the velocity of sound in the particular medium, is responsible for a shock wave of high energy. In 1934 Michel-Levy and Maraour recognized that the shock wave associated with a condenser discharge might be of high energy and described the rapid heating to incandescence of a copper cylinder and a carbon thread when struck by shock waves (sound waves) from a spark source.[2] In 1936 Suits stated that "high intensity sparks are the most efficient means known of converting electrical energy into sound."[3] His calculations showed that the greater part of the energy in high intensity sparks in air is radiated in the form of sound and a small amount as light.

Sparks in Liquids: Spark discharge in a liquid was pointed out as a potential source of power by Pokrovskiy and Stanyukovich[4] in 1944. Experimental verification of this idea was published in the Soviet Union by Roy and Frolov.[5] The latter investigators, by changing the spark gap length,

References are tabulated at the end of the article.

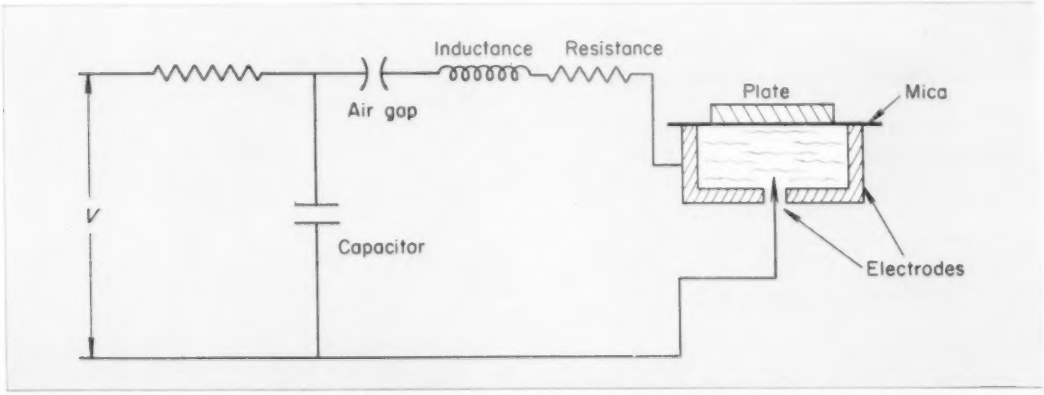


Fig. 1. Schematic diagram of Früngel's apparatus used to conduct early experiments in hydrospark forming.

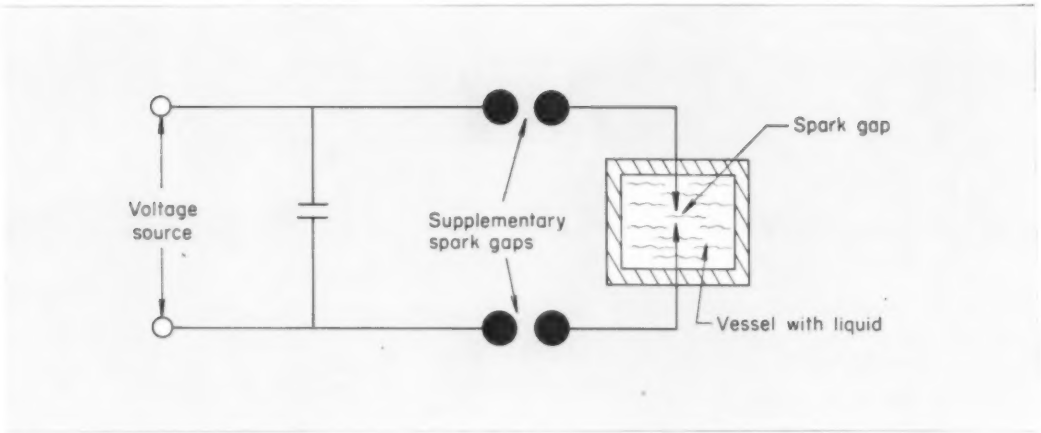


Fig. 2. Basic circuit for producing an electrohydraulic effect.

size of the condenser, and voltage, varied the energy in the sound wave produced by the condenser discharge (the so-called electroacoustical energy). The magnitude of the current and voltage as a function of time was recorded on an oscillograph actuated by a barium titanate transducer. The electroacoustical efficiency, that is, the efficiency of conversion of electrical energy to acoustical energy, was computed as the ratio of the energy in the pressure impulse to the energy stored in the condenser, $CV^2/2$, where C is the capacitance of the condenser and V is the voltage. Pressure-time curves obtained on the oscillograph provided a basis for calculating the energy of the pressure impulse. The maximum efficiency observed was 30 percent when the capacitance was 0.1 mf, the voltage 30 kv, and the spark gap length 4 cm.

Although the acoustical efficiency was relatively high, the mechanical efficiency, that is, conversion of electrical energy to mechanical energy, was found by Früngel[6] to be only about 1 percent. Frungel's experiment was conducted on the apparatus shown in *Fig.* 1.

The discharge gap in the water is from the rod to the cylindrical container. The mechanical effect is measured by the height to which the aluminum cover plate is thrown into the air. The investigators could not account for an observed dimpling of the aluminum sheet.

In 1957, Früngel and Keller stated that the underwater spark has not been used in practice in spite of many attempts to improve its characteristics.[7] This does not agree with a report by Early and Dow[18] and an article by Yutkin,[8] published in 1955, which described a number of practical applications which are discussed in detail later in this article. In comparison with previous work by Früngel, the work by Früngel and Keller showed a conversion efficiency of 50 percent in the bursting of a container of water by an underwater spark. The authors showed an approximate calculation equating the energy of a spark discharge from a 0.02 mf condenser at 20 kv with the energy of 1 mg of an explosive which liberates 1000 cal/g (200 ft-lb/grain). (Cast TNT liberates 1125 cal/g, according to Cook).[17] That the energy of a spark may be useful (for instance, for metal forming) is suggested also by the work of Schaafs.[9] Compression of a liquid dielectric in the region of the spark gap causes an increased capacity for absorption of X-rays. Schaafs studied the spark discharges in bromobenzene and trichloroethylene, using high-speed radiographs of the phenomenon. He determined the velocities of the spark sound waves and the resulting dynamic pressures, and showed that a dynamic pressure between 10,000 and 100,000 kg/cm^2 (140,000 to 1,400,000 psi) is possible. Early and Dow[18] stated that for a 12-kv potential and 12-mf condenser the pressure developed is "of the

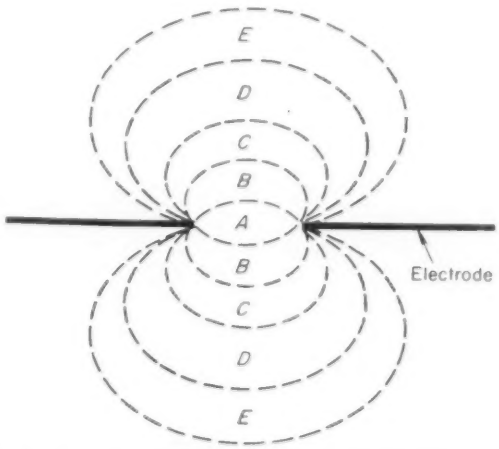


Fig. 3. High pressure zones surrounding the discharge zone. *A* is zone of spark discharge. *B* is zone of rupture. *C* is zone of cold working. *D* is zone of elastic action. *E* is zone of compression.

order of 5000 atmospheres." Martin[19] discussed spark discharges as examples of gaseous conduction at 10,000 atmospheres.

Work of a theoretical nature was conducted by Drabkina,[10] who developed a relationship between the energy liberated in an electrical discharge, the pressure at the front, and the velocity of the shock wave. The formula was verified by Gegechkori[11] and by Dolgov and Mendel'shtam[12] for discharges in air. Bailitis recorded shock waves from underwater sparks, measured the rate of growth of the pressure front, and related the sound wave to the discharge energy of the condenser.[13] Zingerman, in the Soviet Union, related the pressure at the shock wave front to the steepness of the impulse energy front during electrical discharge in a fluid.[14] After making some simplifications of the actual form of the energy pulse, he introduced this into the Drabkina formula and compared the pressures setup by shock waves of the same energy and duration but with fronts of different steepness.

Yutkin wrote a short monograph describing what he terms the "electrohydraulic effect."[8] This effect comes about from creation of a specially shaped impulse by a high-voltage electrical discharge, which leads to a very high pressure in the discharge zone. Yutkin's fundamental circuit is shown in *Fig.* 2.

The supplementary gaps (air gaps), called "forming gaps," were found necessary for the achievement of an intense mechanical effect. The forming gaps permitted a discharge to occur even in an ionic conducting liquid and eliminated vapor evolution previously observed. The air gaps allow the voltage buildup far beyond the breakdown voltage of the liquid. When the air gaps break down, the over-voltage in the basic liquid gap results in a sharp, rapid spark of high current. The circuit used by Early and Dow[18] was similar but did not have forming gaps as such; instead, a manually operated switch was closed until a spark jumped between the contacts.

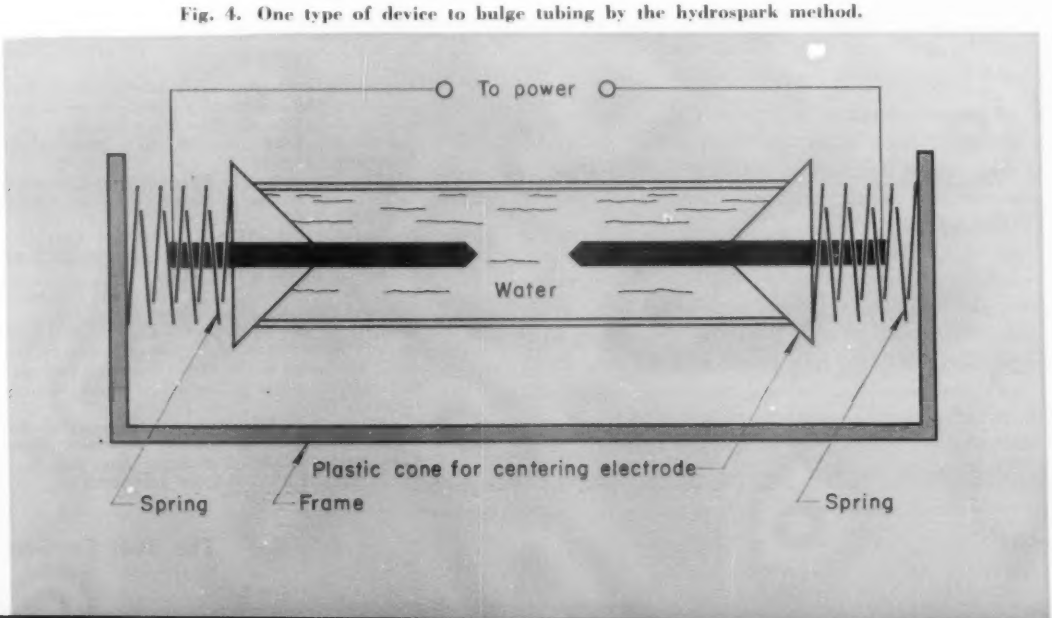
The hydraulic impulse corresponds more or less to the shape of the current impulse. For the development of a short, intense hydraulic shock, the current impulse must be quick, of high amplitude, and have a steep front. In explosives terminology, the shock wave would then be described as having more brissance, that is, shattering action.

Electrohydraulic Effect: It was pointed out by Yutkin that the electrohydraulic method of working metals differs from electrospark machining. The difference between the two methods is in the electrical circuits, physical processes, and energy parameters, as well as the fact that the mechanical action on the workpiece in the electrohydraulic effect is indirectly applied through the liquid medium.

Thus, the electrospark machining of metals, which operates at substantially lower voltage, acts on the metal in a direct line from the electrode to the workpiece, while in electrohydraulic working the force is perpendicular to the line of action of the spark. The thermal action in electrospark working was investigated, for instance, by Zingerman.[15,16] It has been established that the metal in electrospark working is locally melted.

If the liquid in which the spark takes place is dense and incompressible, the spark will heat the liquid to produce a gas which expands rapidly. A high transient pressure is produced, and the pressure created in the spark channel will be almost entirely transferred to the shock wave. Distilled water appears to be a satisfactory dielectric medium in which to produce the effect. In the zone of high pressure surrounding the discharge channel a number of different zones are said to exist. These zones

Fig. 4. One type of device to bulge tubing by the hydrospark method.



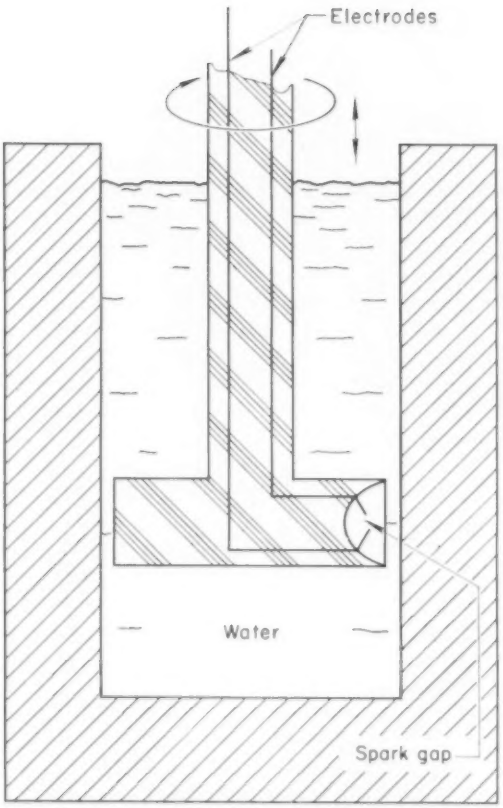


Fig. 5. Suggested method of work hardening the inside of a cylinder using the hydrospark.

are shown schematically in *Fig.* 3. The spark is discharged in zone *A*. In the zone of rupture, *B*, almost all materials would be subdivided into small particles. Cold working occurs in zone *C*; metals placed in this zone can be work-hardened. Zone of elastic action is at *D*. *E* is the zone of compression; the pressure diminishes very rapidly as distance increases from the point of occurrence. Placing the metal specimen in Zone *B* at a distance of less than half the spark gap length is not possible, since it will produce a short circuit.

Electrohydraulic Devices: Experimental bulging of brass tubes was described by Yutkin. Based on his description, the apparatus is drawn schematically in *Fig.* 4. In the apparatus shown, Yutkin was able to bulge a brass tube up to 63 percent of its original diameter, using 10 successive sparks and one intermediate anneal. Because of the accumulation of bubbles on the inside of the tube, it was recommended that the experiment be conducted with the tube in an inclined position. Early and Dow demonstrated the power available in the effect by punching a ½-inch hole in 1/16-inch steel plate by means of an underwater spark.[18]

Much as in explosive forming, the energy may be applied to the metal being worked either through a liquid medium or by actuating a ram which forms the metal. A small forging press based on the electrohydraulic effect could easily be devised where the pressure on the main ram is created by a spark in the liquid medium. Another possible application is the work hardening of metal surfaces. A suggested device for work hardening the inside of a cylinder of an engine is shown in *Fig.* 5.

The electrical spark discharge in liquids appears to be a convenient and powerful method of converting electrical to mechanical energy. The use of the electrohydraulic effect as a metalworking tool has certain inherent advantages, such as simplicity, which may make it economically feasible in metal forming applications.

References

1. Svedberg, T.—"Ueber die elektrische Darstellung einiger neuen colloidalen Metalle," *Berichte der Deutschen Chemischen Gesellschaft*, 38, 3616 (1905). (German)
2. Michel-Levy, A. and H. Muraour—"Sur la luminosite' de ondes de chos," *Comptes Dendus*, 18, 1760, (1934). (French)
3. Suits, C. G.—"Notes on High-Intensity Sound Waves," *General Electric Review*, 39 (9) 430 (1936).
4. Pokrovskiy, G. I. and K. P. Stanyukovich—*Izvestiia Akad. Nauk. Ser. Fiz.*, 8, 214 (1944). (Russian)
5. Roy, N. A. and D. P. Frolov—"On the Electroacoustical Efficiency of a Spark Discharge in Water," *Doklady Adad, Nauk.*, 118 (4), 683 (1958). (Russian)
6. Früngel, F.—"On the Mechanical Efficiency of Liquid Sparking," *Optik.*, 3, 124 (1948). (German)
7. Früngel, F. and H. Keller—"Impulse Sound Sources, Fundamentals, and Analogy to Explosive Transformations," *Zeitschrift für Angewandte Physik*, 9 (3), 145 (1957). (German)
8. Yutkin, L. A.—Elektroqidravlicheskiy Effkt, *Mashqiz, Moskva*, Leningrad (1955). (Russian)
9. Schaafs, W.—"Investigations of Spark Sound Waves by Means of X-ray Flashes," *Z. Naturforsch*, 4A, 463, September, 1949. (German)
10. Drabkina, S. I.—*Zhurnal Eksp. Teor. Fiz.*, 21, 473 (1951). (Russian)
11. Gegechkori, N. M.—*Zhurnal Eksp. Teor. Fiz.*, 21, 493 (1951). (Russian)
12. Dolgov, G. G. and S. L. Mendel'shtam—*Zhurnal Eksp. Teor. Fiz.*, 24, 691 (1953). (Russian)
13. Bailitis, E.—"The Sound Impulse of a Liquid Spark," *Z. Angew. Phys.*, 9 (9), 429 (1957). (German)
14. Zingerman, A. S.—"Pressure at the Shock Wave Front as a Function of the Steepness of the Impulse Energy Front During Electrical Discharge in a Fluid," *Zh. Tekh. Fiz.*, 26 (11), 2539 (1956). (Russian)
15. Zingerman, A. S.—"The Effect of Heat Conduction on Electrical Erosion of Metals," *Zh Tekh. Fiz.*, 26 (9), 2008 (1956). (Russian)
16. Zingerman, A. S.—"The Role of Joule-Lenz Heat in the Electro-Spark Machining of Metals," *Zh. Tekh. Fiz.*, 25 (11), 1931 (1955).
17. Cook, M. A.—*The Science of High Explosives*, Reinhold Publishing Corp., New York, 1958.
18. Early, H. C. and W. G. Dow—"Experimental Studies and Applications of Explosive Pressures Produced by Sparks in Confined Channels," presented as conference paper at the AIEE Winter Meeting, January, 1953.
19. Martin, E. A.—"The Underwater Spark; an Example of Gaseous Conduction at About 10,000 Atmospheres," Univ. of Michigan Eng. Res. Inst., Ann Arbor (UMN-2048-12-F) July, 1956.

OLD building blocks make NEW transfer line

CONFRONTED with the cost and inflexibility of transfer machines when product design changes are made both users and tool builders are now relying on the building-block concept as an answer to their problems. Illustrating the advantages of the building-block design is the new 35-station transfer line shown in *Fig.* 1. Designed by the Barnes Drill Co. for machining aluminum transmission cases, it utilizes elements from an obsolete block line, thereby demonstrating that the major drawbacks of transfer machines can be minimized.

Building Blocks Re-used: In both the older block line and the new transmission case line, the base, unit, and slide assemblies of the machine are separate. To build the new line, individual building blocks of the old line, as in *Fig.* 2, were shipped back to the factory. Since standard mounting dimensions are used, units and motors are easily mounted on new slide assemblies to compose stations in the new line, *Fig.* 3. At some stations in the new line the slide was to operate at a different level than in the old line. The change in horizontal axis of a unit was achieved by inserting a filler block between the slide assembly and the base.

Even electrical equipment was re-used. Cabinets, switches and starters from the old line were returned to the factory with the building blocks. Rebuilding the electrical equipment and incorporating it in the new line contributed to the savings realized.

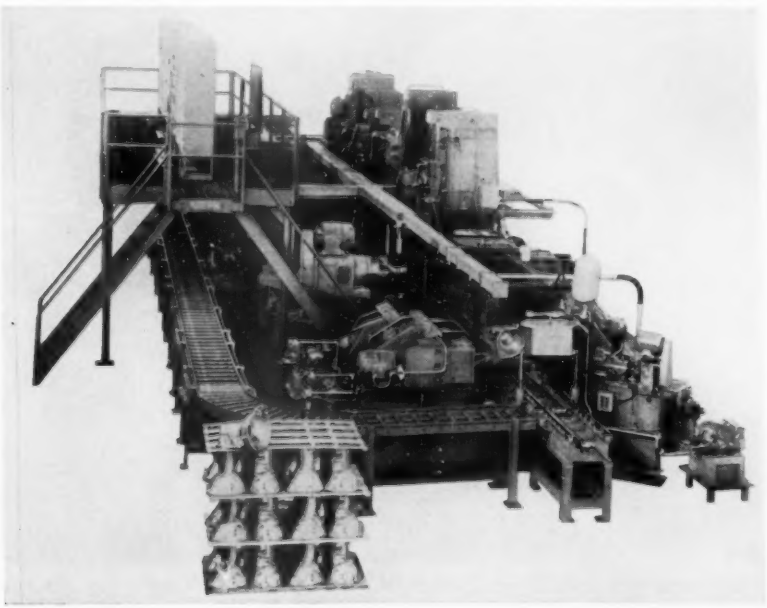


Fig. 1. Transmission case transfer machine rebuilt from obsolete motor block line.

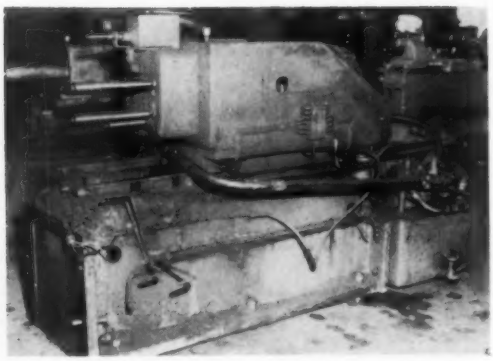


Fig 2. Chip-covered unit of old motor block line.

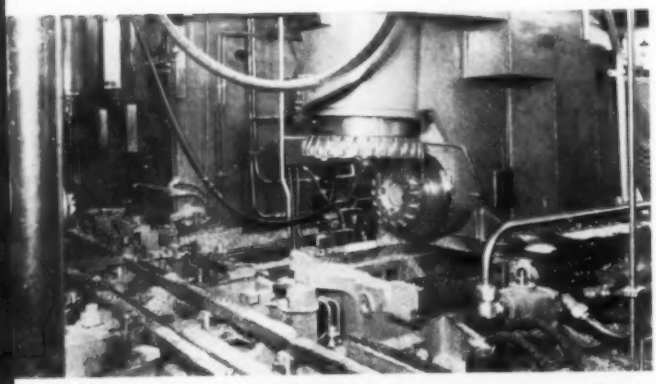


Fig. 3. Stations in the new transmission case line.

Operation: A pallet type transfer mechanism is used, as shown in *Fig.* 4. During the machining operation, transmission cases are carried on pallets that are hardened on five sides, with fixturing fastened to the sixth side. For good housekeeping, drip pans are placed under all hydraulic units. A flume disposes of chips and waste hydraulic oil. Since the pallets rise very little off the rest pad for indexing, they automatically sweep chips into the flume. "Pot" type heads are used. On most of the drilling units, stub type drilling eliminates the need for guide bushings.

The 35 stations of the new transfer machine perform drilling, tapping, reaming, boring, milling, and facing, at a rate of 100 cases per hour.

Future Adaptability: To cope with design changes in the transmission cases, the line can be modified by changing the pot type heads. The pallets can be re-used by changing the fixturing. If extensive changes occur in the future, building blocks of the transmission case line can once more be rearranged to suit the machining needs of the new product.

Transfer lines contribute greatly to high production rates at low cost, but are costly and inflexible when product design changes occur. However, as demonstrated by this example, the building-block design philosophy is doing much to render transfer machines more adaptable to changes in product design and to entirely new products.

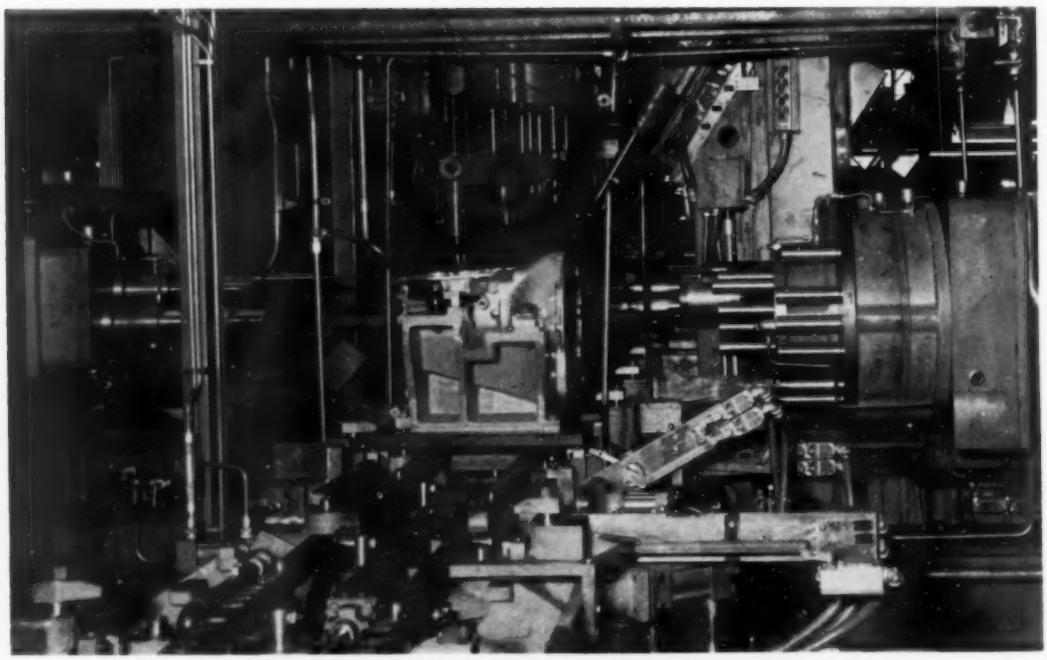


Fig. 4. View from infeed end showing pallet and pot type head.

Fig. 1. End of pipe in position in turret lathe for removal of weld bead. Other end of pipe projects outside of building.

flash welding, mechanization speed drill pipe production

By L. F. Wolfram
Planning Engineer
Reed Roller Bit Co.
Houston, Texas

Mechanical handling and automatic controls have minimized effort and improved quality in the manufacture of oil-well drill pipes. A fully modern plant is described by the author, who also shows how flash welding has made a significant contribution to the efficiency of well-drilling equipment.

DRILLING FOR OIL calls for creative tool engineering. Tool engineers design the special bits that cut through solid rock to reach oil hundreds or even thousands of feet beneath the surface of the earth. Tool engineers are also responsible for the design of the drill pipes that transmit rotary motion to the tool bit. These drill pipes are assembled from sections that are threaded together. As the tool penetrates into the earth additional drill pipe sections are added as needed.

Performance of the entire drilling operation depends, to a large degree, on the reliability and strength of the tool joints. Tool joints have two members called the pin and the box, respectively. These members are of alloy steel, heat-treated for the best possible combination of strength, hardness and fatigue resistance. Special thread forms are utilized to give maximum strength.

Because of the size of the pipe and high reliability requirements, special manufacturing and handling techniques are used, *Figs.* 1 and 2. The joints are permanently connected to the ends of the drill pipes by flash welding, *Fig.* 3, which has proved to be a more satisfactory method than shrinking or conventional welding methods.

Pipe Handling Mechanization

Length of the pipe creates some unusual in-process handling problems that have been solved by an ingenious system of racks, conveyors, elevators, turn-around devices and the like. The pipe, which arrives at the plant by either truck or rail, is unloaded by an overhead crane equipped with an electric magnet and is stored on racks to await manufacturing operations.

To begin the processing cycle, pipe to be processed is transferred from the storage racks, again using the overhead crane and magnet, to a rack. These racks slope toward motorized feed rolls to allow the pipe to roll into proper position to be transferred, one piece at a time, to the rolls by an escapement mechanism. The feed rolls move the pipe to an elevator, *Fig.* 4, where it is elevated to roll by gravity along work racks to the various work stations. Suitable stops and escapement mechanisms are provided at each station to transfer the

pipe, one piece at a time, from the rack to the powered rolls that move it longitudinally into proper position for the operation to be performed, *Fig.* 5.

The pipe loses elevation as it rolls along the gravity racks, eventually reaching a point so low that it is no longer practical to work on it. This difficulty has been overcome by dividing the racks into several relatively short sections. The difference in elevation between the beginning and end of each section does not exceed limits established for proper operation. A profile along the entire rack thus resembles the cutting edge of a saw blade. Suitable lifting mechanisms are employed to raise the pipe from the low point of each rack section to the high point of the succeeding one. In this way, gravity is used almost exclusively to move the pipe between the various operations.

The screw conveyor that moves the pipe through the heat treating operations following welding, *Fig.* 6, is an exception to this general principle. Proper heat treatment requires that the cycle be variable, but uniform when established. The screw is constructed of a section of six inch diameter tubing with ½ inch rod wrapped around it in the form of a helix and welded in place. The tubing is supported on pillow blocks, parallel to the work rack rail, and adjusted vertically so that the OD of the tubing is slightly below the top of the rail. The drill pipe then is supported by the rails and not by the screw conveyor tubing. The ½ inch rod helix projecting above the top of the rails contacts the pipe and rolls it along the rack as the conveyor is turned. A variable speed drive is provided so that the cycle time can be varied as required.

Overhead cranes have been eliminated from the plant entirely except over the pipe storage area. This makes it possible to house the manufacturing facilities in a relatively light prefabricated building. Additional savings in building cost were obtained by providing slots along the building sidewalls to receive only the end of the pipe being worked on *Fig.* 7. The remainder of the pipe remains outside on the racks at all times.

Duplicate manufacturing facilities are provided in the north and south sides of the building. A lenth of pipe can be completed with a tool joint welded to each end by transferring it around the building on the racks and without turning it end for end. There are times, however, when it is desirable to set up the two manufacturing lines for different orders. When this occurs, the tool joint is welded to one end of the pipe and the succeeding operations completed, after which the pipe is turned end for end outside the building and returned to the starting point on the same side of the building by the powered rolls. The pipe, following the second weld, is returned to the storage racks by powered rolls. At this point, it is automatically removed from the rolls and allowed to roll down a short inclined rack to be accumulated. Periodically, the overhead crane operator picks up the pipe and returns it to the appropriate storage rack.

The mechanisms and structures for turning the pipe end for end when required are unusual. The 180-degree reversal is made in two steps. Pipe rolls from the rack onto a cradle on top of a hydraulic elevator and is lifted between and above the two cantilever members. The elevator turns 90

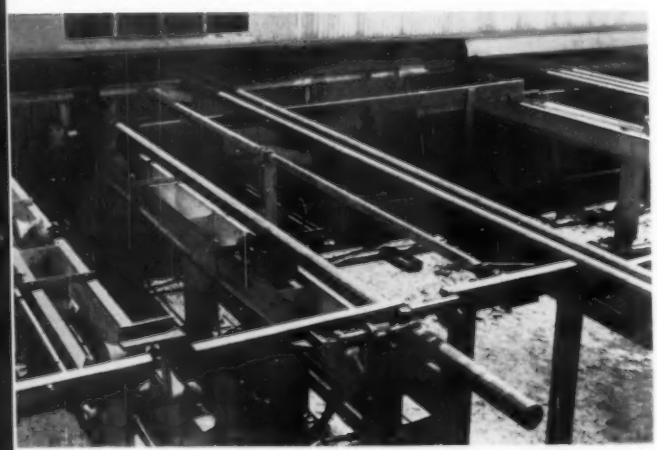


Fig. 2. Mechanized handling equipment moves pipe through successive operations on end to which tool joint has been attached.

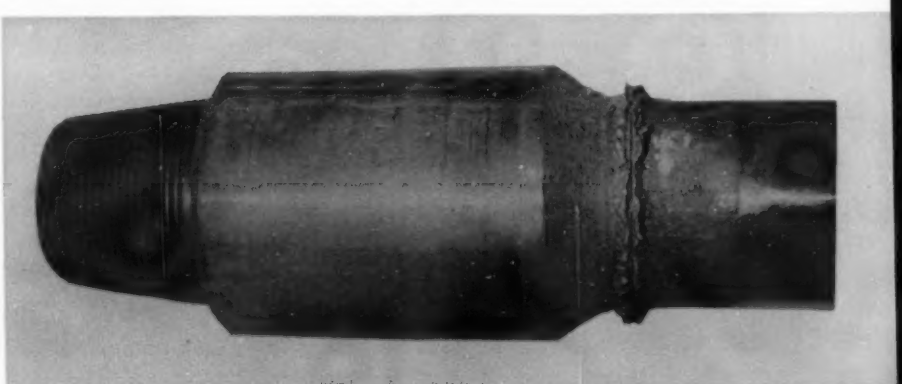


Fig. 3. (right) Tool joint after it has been flash-welded to end of pipe. Weld area is cleaned up by machining as shown in *Fig.* 1.

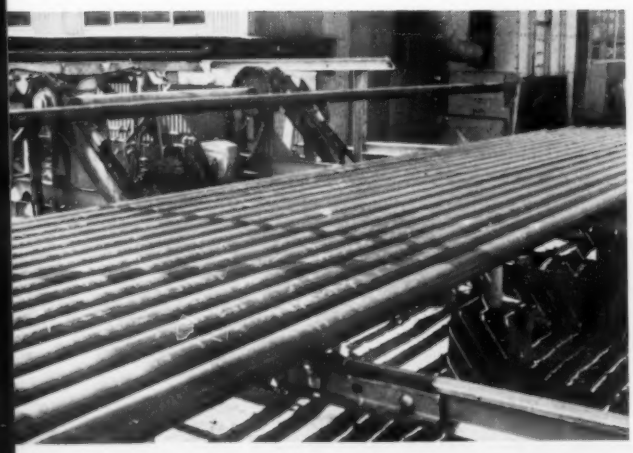


Fig. 4. Elevator raising pipe to work rack at beginning of operations. Mechanized handling speeds production.

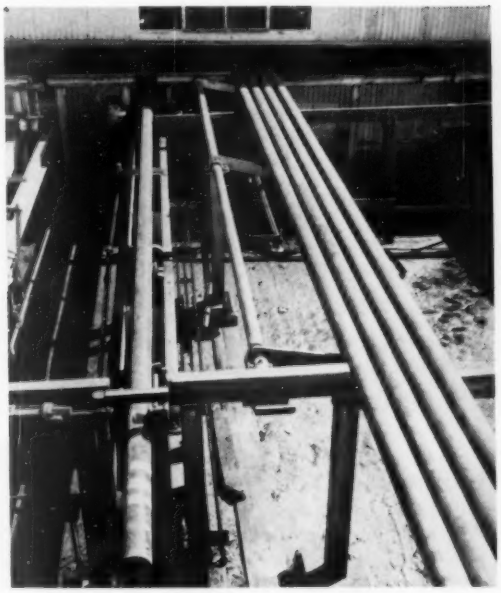


Fig. 5. (right) Arm type escapement mechanism for transferring individual pieces of pipe to feed rolls.

degrees at the top of its travel and then moves downward. The pipe is then deposited on the two cantilever arms and rolls away to the transfer rolls at the opposite end. At this point one-half of the 180-degree reversal has been completed. The hydraulic elevator continues its downward movement, turns back 90 degrees to receive another piece of pipe and the cycle is repeated.

The transfer rolls move the pipe to the opposite end of the building where it is kicked off automatically onto a cantilever structure. Notches and horns at the end of the cantilever arms receive the pipe and position it accurately with respect to a hydraulic elevator, *Fig.* 8.

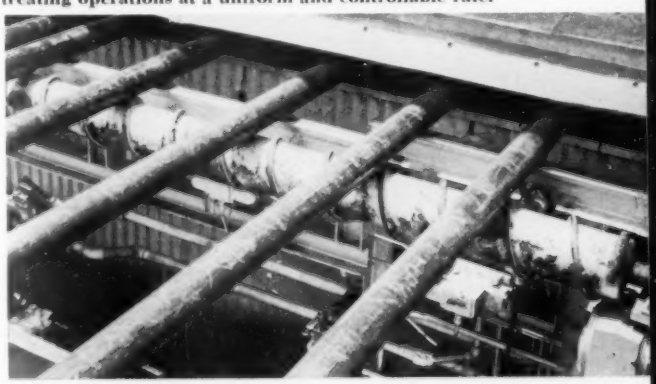
Cam bars on the elevator cradle contact the underside of the pipe as the elevator rises, and lift it out of the notches and over the horns at the end of the arms. The position of the elevator with respect to the ends of the arms is such that after this transfer is completed, the pipe will clear the ends of the racks on its downward movement. The elevator rotates 90 degrees during its downward travel (after passing the arms) and deposits the pipe on the work racks below. This completes the 180-degree pipe reversal required. Handling operations are entirely automatic. The required cycle is set up by a system of selector switches at a central control station.

Welding Operations

Mill scale and protective varnish must be removed from the end of the pipe so that the welding electrodes can make proper contact. This is accomplished in an airless shot-blasting machine. The end of the pipe enters the cabinet through a rubber seal and is positioned under the blast. A rubber-faced plug seals the end of the pipe to prevent the entrance of the blasting grit. Contact with the plug is also used to stop the powered transfer rolls and start the rolls which rotate the pipe during the blasting period. The various motions are reversed at the conclusion of the cleaning period and the pipe is returned to the work rack.

It is essential that the end of the pipe be preheated prior to welding to obtain a satisfactory weld. An induction heating unit is used for this purpose. The heating coils operate directly from a 440-volt, 60-cycle source. No step-down transformer is employed. The heating period is automatically timed to obtain the correct pipe temperature. Controls of the heating unit are interlocked with the controls of the welding machine to assure that a piece of

Fig. 6. Screw conveyor moves pipe through heat-treating operations at a uniform and controllable rate.



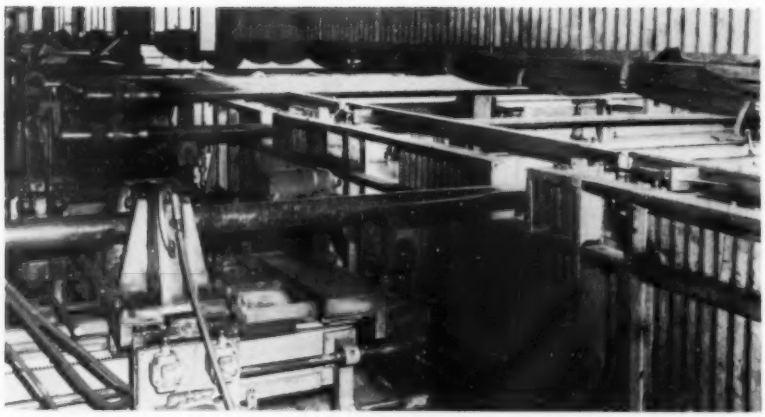


Fig. 7. Slot in wall of building. Outer end of pipe is on rack; inner end is suported in position for machining.

pipe is available when required by the welding machine.

The tool joint is placed in position in the welding machine from a point above the electrodes. An automatic elevator moves the tool joint from a storage rack to an electronic preheater on the welding machine platform, *Fig.* 9, from which it is transferred manually to the electrodes. The tool joint preheater, *Fig.* 10, is much the same as that used for preheating the pipe. It is essential that the axis of the tool joint be accurately aligned with the axis of the pipe to which it is to be welded. This is accomplished by locating the tool joint on a tapered adapter on the crest of the threads, which have been top hobbed, *Fig.* 11. The electrodes that grip the tool joint and the pipe are bored in position with respect to this adapter.

The welding cycle consists of two phases: heating and upsetting. The tool joint and drill pipe are gripped securely by copper electrodes, *Fig.* 12. The tool joint is then moved toward the pipe until contact is established between the two. Only a relatively small axial force is required for this purpose. The tool joint and drill pipe now represent opposite ends of a relatively low voltage, high current electric circuit. The small axial force employed usually results in initial contact being established in a number of small localized areas. The welding current passing through these small areas heats them to incandescence and causes small particles of molten metal to be blown out in a shower of sparks. This action continues until the two abutting surfaces reach a fusing temperature and a zone of plastic

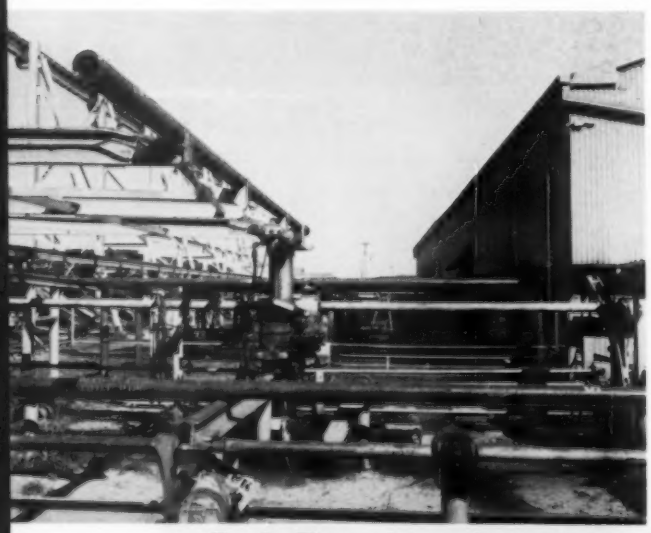


Fig. 8. Elevator for transferring pipe from cantilever arms to work racks.

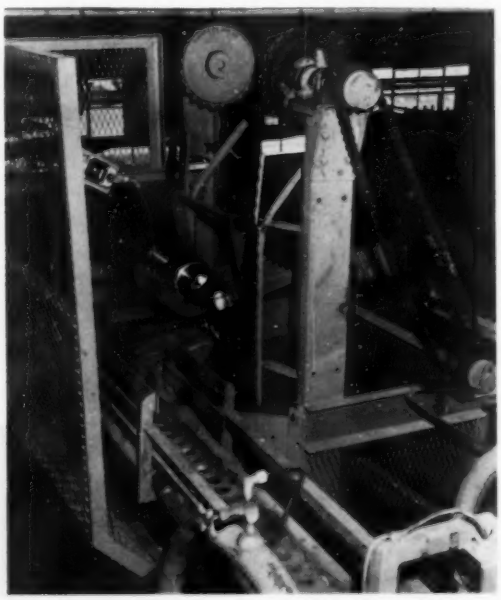


Fig. 9. (right) Discharge point of elevator. Tool joint will be deposited on projecting fingers when cradle moves downward.

metal is established back of the two surfaces. Upsetting pressure is then applied rapidly and the welding current is cut off.

The upsetting squeezes out oxides and other materials that may have remained between the two surfaces and at the same time provides the forging pressure that unites the two. The quality of the weld is determined, to a large extent, by proper timing of the heating and upsetting phases of the cycle. The relationship between these two variables is strictly empirical and must be determined by experiment. Proper control is secured by limit switches and measuring devices actuated by the motion of the welding machine platen.

Pipe with the tool joint attached is automatically removed from the welding machine by powered rolls and returned to the rack outside the building. Each weld is inspected immediately after its completion to be sure that the alignment between the tool joint and pipe is within the required tolerance. Pipe that fails to pass this inspection is moved by rolls to a reject station. The tool joint is subsequently cut off the pipe and the pipe returned for reprocessing.

Each weld is heat treated to secure proper metallurgical characteristics in the steel in the weld zone. Sixty-cycle induction heating coils, similar to those employed for preheating the pipe are used for this purpose. Each must be designed for a specific job because of the difference in cross sectional area of the pipe and tool joint.

Machining after Welding

The metal upset in the welding operation must be machined from both the OD and ID of the pipe, *Fig.* 1. This is done on several turret lathes that were modified and equipped with special tooling to adapt them to the operation. The regular turret and cross slide assemblies were removed and discarded. A special slide consisting essentially of a lower slide, upper slide, automatic power operated indexing tool turret, and pipe back-up rolls was then fitted to each machine.

The lower slide is attached to the lathe in a conventional manner and is used for feeding the cutting tools parallel to the work. The upper slide with the tool turret and back-up rolls mounted on its top surface is then fitted to the lower slide to form a compound arrangement, *Fig.* 13. Relative motion between the two slides in a direction perpendicular to the axis of the lathe is permitted but it is limited by a large coiled spring.

The pipe is rotated for machining by chucking on the OD of the tool joint. The top slide is moved towards the front of the machine until the two back-up rolls contact the pipe and the coiled spring is compressed. The cutting tool is then fed to the work in a conventional manner using a secondary slide motion built into the tool turret. Thus the pipe

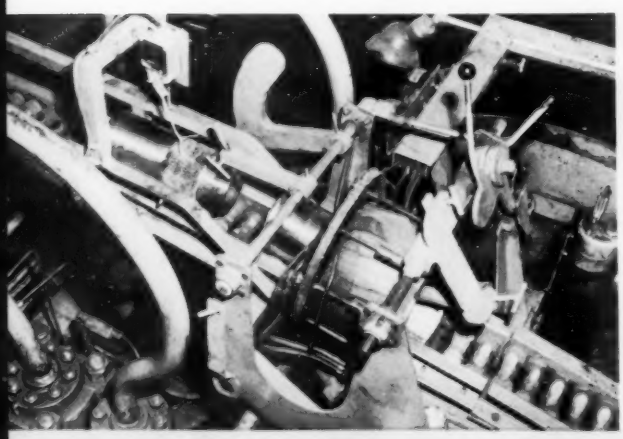


Fig. 10. Tool joint preheater. Preheating operation is automatically controlled.

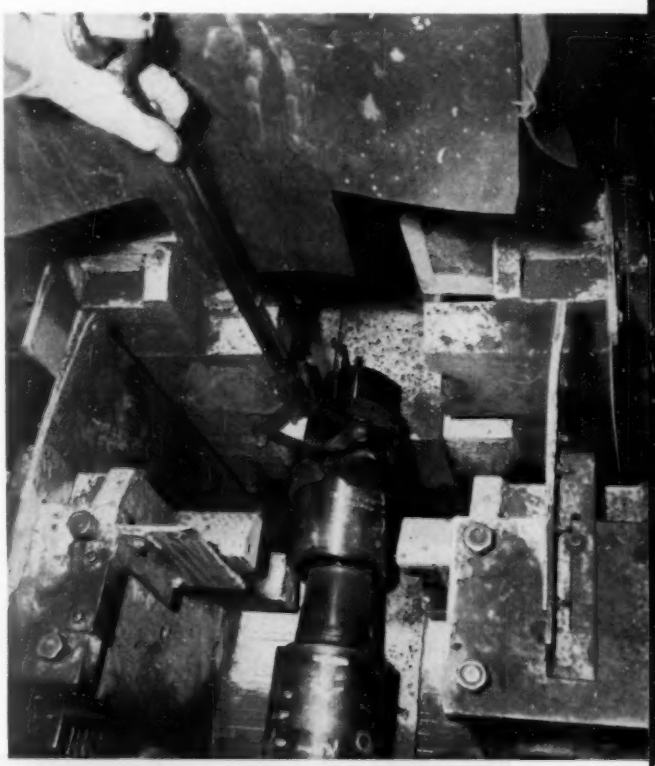
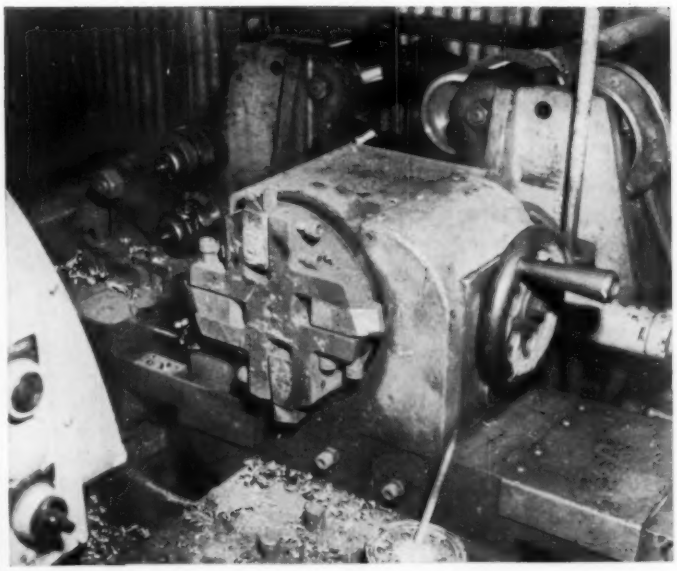
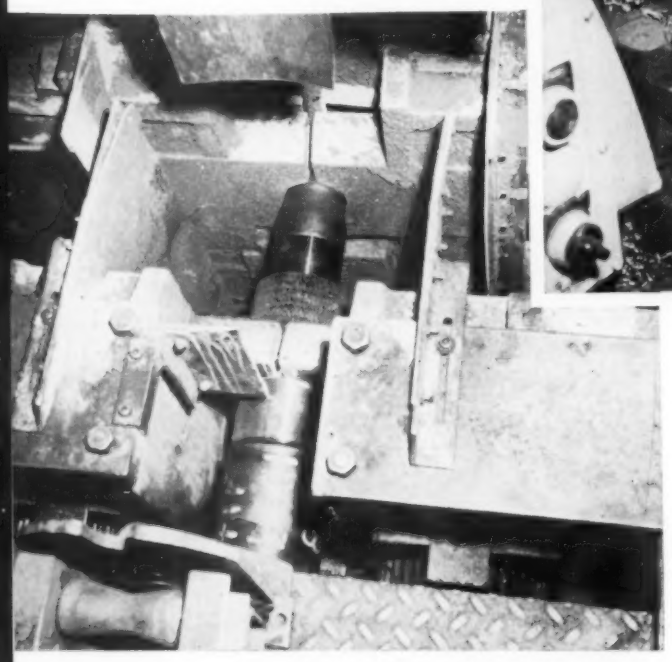


Fig. 11. Tool joint box about to be located on tapered plug for welding.

Fig. 13. (right) Special slide, indexing toolpost and back-up rolls are used on lathe. Pipe is entering from upper right.

Fig. 12. (below) Tool joint and pipe in position for welding.





is restrained between the cutting tool and the back-up rolls, which function as a cam follower. Any irregular motion of the OD of the pipe due to the lack of concentricity between it and the axis of rotation resulting from normal tolerance of manufacture will be transferred by the rollers to the cutting tool, because they are on the same slide. It is therefore possible to machine the upset off the OD of the pipe without danger of undercutting. A floating, hydraulically operated boring bar, operated through the hollow spindle of the lathe, removes the upset from the inside of the pipe.

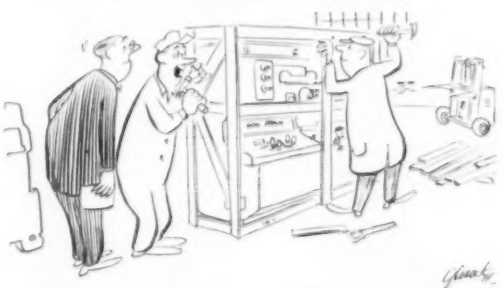
The plane of rotation indexing of the tool turret is vertical, instead of horizontal, because there is insufficient room to properly index the tools in a horizontal plane.

The centerline of the spindle of each lathe is located approximately one foot below the pipe rack outside the building. A short open space is left in the rack opposite the centerline of each machine. Each open space is then bridged by a hydraulically-operated gate controlled by the machine operator. Each is also fitted with a mechanism for lowering the pipe from the rack to the machine centerline.

Pipes roll by gravity to the machines and are lowered through the gap. Then the bridge automatically closes the gap and the pipe is moved by powered rolls to the machine chuck. Finished pipe is removed from the machine by reversing these motions. The entire operation is automatic with the controls interlocked so that no two rail gaps can be opened at the same time. It is thus impossible for an accident to occur as the result of two operators signaling for pipe at the same time.

To remove any tool scratches that might lead to fatigue failures, the machined surface in the vicinity of the weld is carefully sanded to a very smooth finish. Each weld is given a final inspection for dimensional and alignment accuracy and then Magnafluxed to detect any surface irregularities. The OD of the tool joint is then painted, the threads greased, thread protector applied, and the pipe moved to the storage yard by powered rolls.

Flash welding has proved to be a highly reliable method—so reliable, in fact, that not one flash-welded connection produced by the equipment described has failed in field service.



"We're trying to beat obsolescence by shipping it before it's quite complete—"

WEIGHT OF BAR STOCK *is quickly calculated*

By James H. Dodge*
Latrobe Steel Co.
Latrobe, Pa.

QUICK MENTAL CALCULATIONS for the weight of bar stock may be made easily, using a simple formula. This method was developed during a routine check of steel inventories. It was observed that a 12-foot long bar of 1-inch diameter carbon steel weighs 32 pounds. This fact is interesting only because the diameter is the unit dimension and the weight is the common denominator of fractional sizes.

If the length of round bars is held constant, the weight varies directly as the square of the diameter. To simplify the calculation, express the diameter as an improper fraction, such as $N/2$. Then the equation becomes, using W for the unknown weight,

$$\frac{W}{32} = \frac{N/2)^2}{(1)^2}$$

$$W = 32\,\frac{N^2}{4} = 8N^2$$

This shows that the weight of a round bar of carbon steel, 12 feet in length is 8 times the square of the numerator of the bar diameter expressed as halves. For example, a 1½-inch diameter becomes 3/2 and the weight of a 12-foot bar becomes $3^2(8) = 72$ pounds.

When this method is applied to sizes expressed as ¼, ⅛, and 1/16 an easily remembered pattern evolves. To calculate the weight of 12-foot long round bars the following relations are needed:

This can easily be remembered by thinking 8-2-2-8 and realizing that the larger sizes require multiplication and the smaller sizes division.

Determination of Round Bar Weight (Sample Calculations)

Bar Diameter (in.)	Numerator of Improper Fraction	Mental Weight Calculation	Weight of Bar (lb per 12 ft)
9/16	9	$9^2 \div 8$	10⅛
1¼	5	$5^2 \times 2$	50
1⅜	11	$11^2 \div 2$	60½
2	4	$4^2 \times 8$	128

This method is not an approximation but an exact method. Unfortunately, no such simple formula evolves for flats and squares. It does help to remember that a 1-inch square bar, 12 feet long weighs 41 pounds so that an approximation can be made by multiplying the area by 40. The exact weight of flats and square bars can be computed by using the following rule:

$$W_{12} = (40 + 1)A$$

where W is the weight in pounds of a 12-foot length of bar and A is the cross sectional area of bar.

To illustrate the application of this simple and convenient formula, the following table shows calculations for the weights of three flat-bar sizes.

Weight of Bar Round Stock

Diameter Expressed in	Weight of Bar* (lb per 12 ft)
Half inches	$N^2 \times 8$
Quarter inches	$N^2 \times 2$
Eighth inches	$N^2 \div 2$
Sixteenth inches	$N^2 \div 8$

*N is the number of ½'s, ¼'s, ⅛'s, or 1/16's in diameter of bar expressed in inches.

Weight of Flat Bars

Bar Size (in.)	Weight Formula* $(40 + 1)\,A$	Weight of Bar (lb per 12 ft)
2 x 2	$(40 + 1)\,4$	164
1 x 2	$(40 + 1)\,2$	82
2 x 4	$(40 + 1)\,8$	328

*A is the cross-sectional area of bar expressed in square inches.

*Senior member ASTME Detroit chapter.

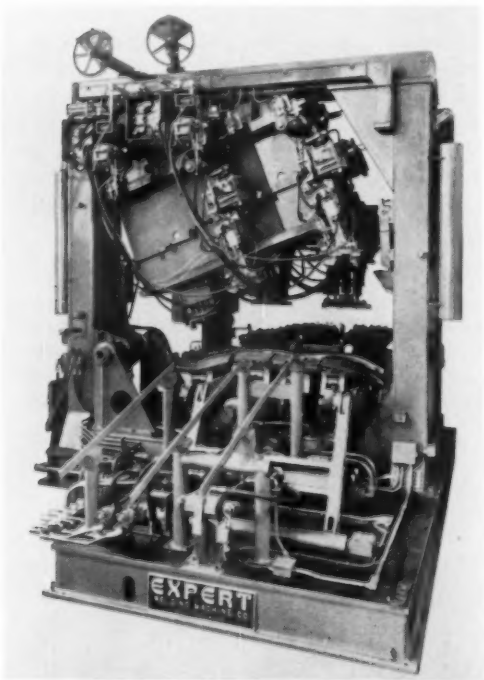
designed for

PRODUCTION

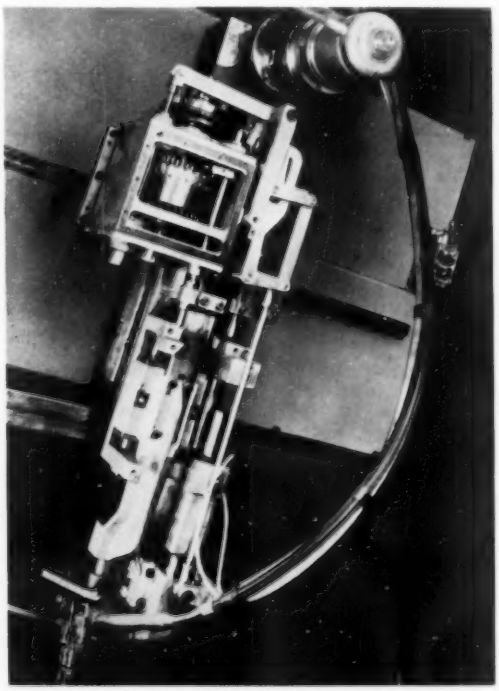
Welding Machine Follows Out-of-Tolerance Contours

Weld line edges of channel halves often deviate from print dimensions by as much as $\frac{3}{16}$ inch. In fabrication of automotive side rails and cross members dimensional inconsistencies of this order are acceptable but they preclude the use of conventional cam-controlled welding machines. To make welding operations on these parts fully automatic, Expert Welding Machine Co. of Detroit has developed a welding machine with a tracer system which provides for side movement of the welding heads, enabling them to follow irregular contours.

The tracer system consists of two basic units—a probe and a mechanical memory device. In operation the probe follows the irregular weld edge relaying information to the memory device. This is accomplished by movements of the probe which change the position of pins in a revolving drum. As drum revolution carries pins past an output shaft, a roller contacting them "reads" their height to correctly position the welding head.



AUTOMATIC WELDING MACHINE for fabrication of side rails and cross members. Welding heads follow irregular contours which vary from part to part.



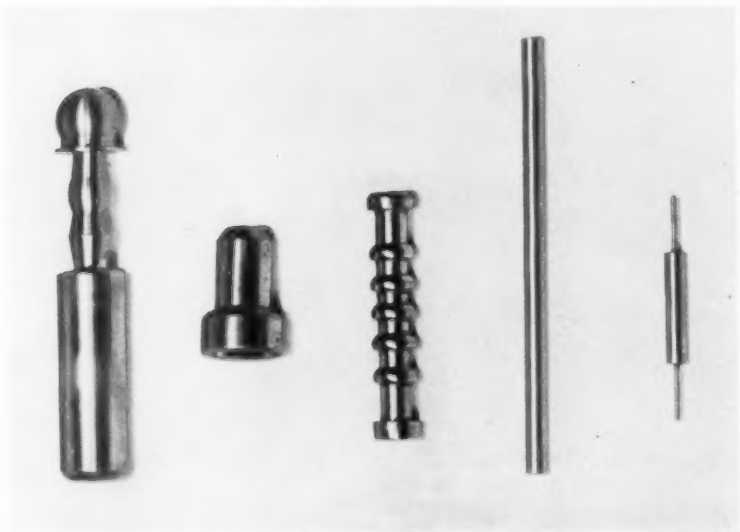
FOLLOWER SYSTEM for welding machine. Enclosed drum, upper center, acts as a mechanical memory system adjusting head position according to pin height.

Conversion Attachment for Surface Grinders

An attachment that enables surface grinders to perform cylindrical grinding operations on small components has eliminated many of the part-holding problems commonly associated with conventional grinding practice. Designed for small parts with complex profiles, the attachment provides perfect concentricity without the use of centers, chucking devices or indicators. In operation the workpiece is positioned on an abrasive-surfaced drive cylinder and against an adjustable carbide rest blade. A nylon-faced roller equipped with an adjustable torsion spring-loading device holds the workpiece in place while permitting it to rotate. To prevent end motion of the workpiece, the center line of the roller is angular to the center line of the drive cylinder. This design feature creates a moment on the workpiece, effectively holding it against a carbide-faced ball. Driven by a variable-speed gearmotor, the drive cylinder is kept free of foreign matter by an adjustable spray coolant system and a wiper.

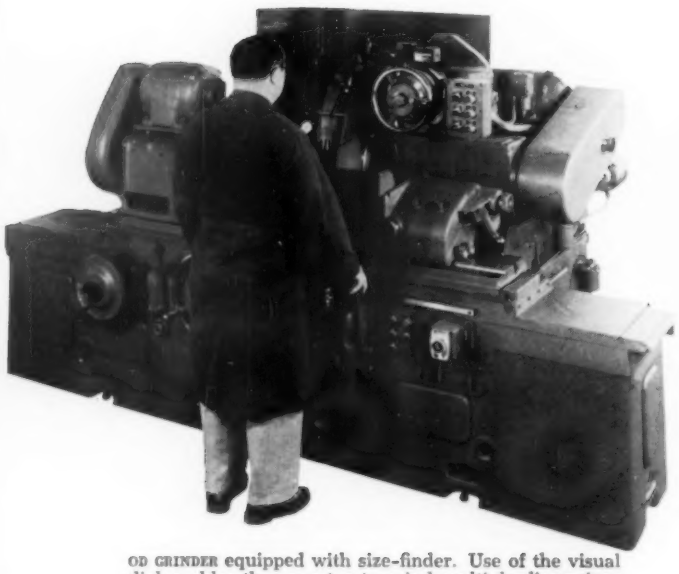
The attachment, manufactured by Products Supply Co., Ferndale, Mich., is adaptable to through-feed grinding by means of interchangeable details. Provisions for use of the attachment on internal grinders are also included in its design.

CONVERSION ATTACHMENT utilizing surface grinder for cylindrical grinding. Range of the fixture is from zero to three-inches on cylindrical step and through-grinding operations.



SMALL PARTS finished on the Mini-Grind attachment. Versatility of the unit exceeds that of conventional OD grinders for small jobs.

Diameter Sizes Dialed on OD Grinder



OD GRINDER equipped with size-finder. Use of the visual dial enables the operator to grind multiple dimensions without racking parts between operations.

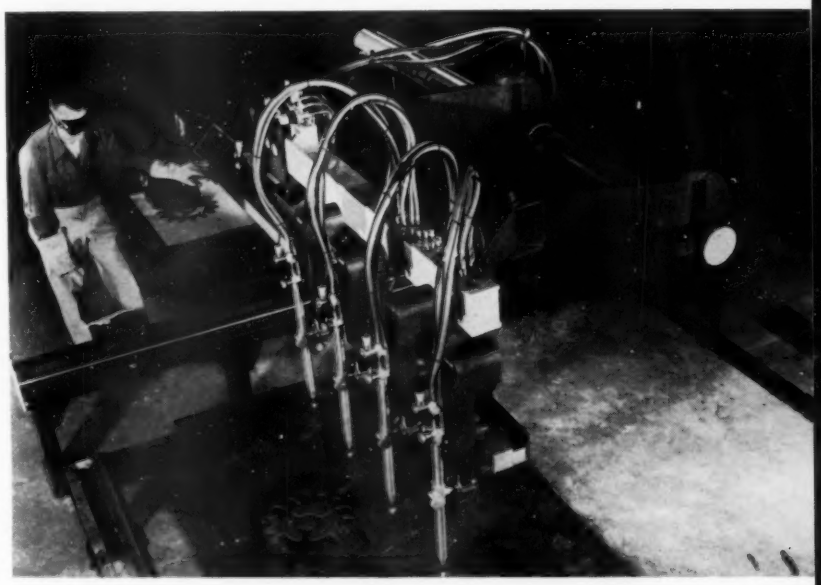
Shafts having two or more diameters are quickly and accurately ground through visual indication of part size on a recently developed Landis grinder. Utilizing a direct-reading counter calibrated to the feed handwheel, the grinder enables operators to dial any specified size by turning the handwheel until the dimension appears. It is then possible to grind other diameters in a similar manner without removing the workpiece from the machine. Removal of the workpiece is time consuming and has an adverse effect on concentricity of different diameters.

Diameters wider than wheel width can be ground with a series of plunge cuts to within a few tenths of finish size. A subsequent finish pass, dialed to size, removes all overlap marks leaving a straight, smooth finish.

SIZE FINDER MECHANISM, shown above the feed wheel, is essentially a counter calibrated in tenths of a thousandth. Geared to infeed wheel, it provides for rapid and accurate grinding wheel movement.

Flame Cutter Has Centralized Controls

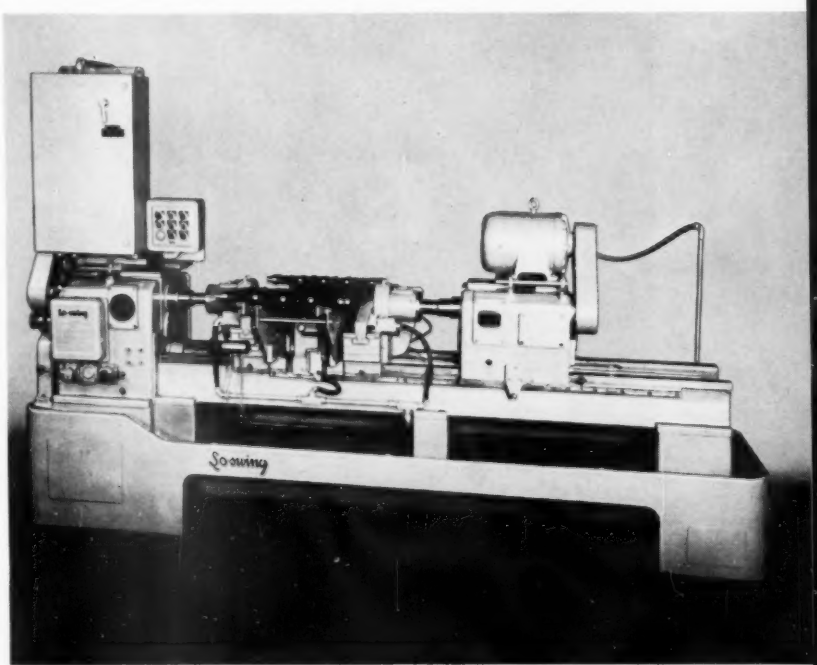
Built for shape cutting on eight-foot steel plate, this flame-cutting machine of pantograph design carries four motorized torches. Fueled with acetylene, propane or natural gas, the machine is capable of shape and straightline cutting anywhere within a 96 inch wide rectangle of variable length. Principal design innovation in this flame cutter is centralized control of all machine functions. All controls for gas pressure, motorized torches, machine carriage and the tracing device are located directly above the tracing table. Called a Linagraph, the machine is manufactured by the Air Reduction Co., Inc.



Loader Automates Center Drilling Operations

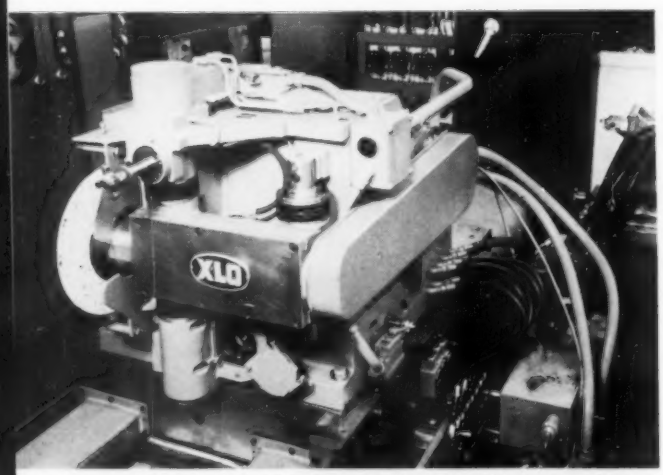
Center drilling operations on cam shafts are automated by a special loader on a Seneca Falls centering and drilling machine. Components of the device include a stationary cradle for receiving finished parts from the machine as well as arms for loading and unloading the work. Vise jaws in the machine hold the work, during machining, opening and closing in conjunction with the loader.

Action of the loading device is initiated at the end of a machining cycle when a finished workpiece is dropped into the cradle. Motor-driven unloading arms pick up the finished part depositing it on conveyor rails while the loading arms place an uncentered part in the machine. Automation of the operation is completed by conveyor transportation to and from the center drilling machine.



DESIGNED FOR PRODUCTION

Tape-Controlled Machine Turns, Bores and Grinds



TURNING and boring spindle with spherical workpiece. Infinitely variable spindle speeds are obtained through hydraulic motor. Tool speed remains constant throughout duration of the entire turning operation.

GRINDING UNIT which can be interchanged with turning and boring head. Cross-slide movement for either head is effected manually or by tape control in increments of 0.000025 inch. Wheel dressing can be taped.

Space Age components with tolerances measured in millionths of an inch can be produced on the Ex-Cell-O numerically controlled machine illustrated. The machine, designed for numerically controlled turning and boring, and grinding, utilizes building-block construction. This makes conversion from one operation to another possible.

The boring and turning unit, like the grinding unit, is self-contained. When turning the OD or boring the ID of hemispheres, cutting speed is maintained constant by hydraulically varying spindle speeds.

The reciprocating grinding head is capable of grinding accurate template contours and similar complex forms on flat stock. Use of a rotary attachment mounted vertically on the cross slide enables the machine to grind circular cams. Wheel dressing is accomplished manually or numerically.

To maintain required tolerances the machine is operated at a constant temperature of 72 F. Heat from electronic equipment is ducted away and the hydraulic power unit is water-cooled.

Analysis of CUTTING FORCE ... a work-energy approach

By Heinrich Heinmann
Stress Analyst
Truarc Retaining Rings Div.
Waldes Kohinoor, Inc.
Long Island City, N. Y.

Cutting force and horsepower for machining operations can be quickly calculated for any material when the shear angle and the ultimate shear strength of the material are known.

ALMOST all machining operations are similar. To cut metal it is necessary to apply a certain cutting force tangential to the surface of the workpiece and a certain horsepower to the cutting edge of the tool. This is true whether the cutting operation is done with a cutter bar in a lathe, with a grooving tool mounted in a drill press, or with any other cutting tool-machine setup.

The amount of cutting force which must be applied is dependent upon two factors: the width (depth) of the cut and the feed rate. Horsepower is dependent upon the volume of removed material per minute (unit chip volume).

The single static arrangement illustrated in *Fig.* 1 may be helpful in establishing certain basic relationships which must be considered in any machining operation. These are: (1) Cutting force and horsepower at the cutting edge of the tool in relation to shear strength and shear angle of the workpiece; and (2) the relationship between the shear angle and

(a) the coefficient of external friction of the chips along the tool face,
(b) the coefficient of internal friction along the shear surfaces of the chips and the workpiece, and
(c) the true rake angle of the tool.

Formation of a single chip is illustrated in *Fig.* 1. This chip is produced by a straight-faced punch, i.e., a cutter having a zero rake angle. A strip of thickness a and width (depth) w of the workpiece is exposed to an increasing thrust load by the straight-faced punch. If the increasing thrust load reaches a certain value P (called cutting force) a chip is separated from the workpiece along a shear surface inclined to the axis of the punch under an angle θ, called the shear angle.

Laboratory tests show that this angle depends mainly on the properties of the workpiece material. If the cutting force P is maintained, an uninterrupted series of single, more or less separated shear chips is formed, all of them separating from the workpiece under the same shear angle.* The initial condition between load P and shear resistance of

* See "Effect of Machining Forces on Tools," by Robert E. McKee, THE TOOL ENGINEER, July 1959, p. 65-72, especially p. 70, left column.

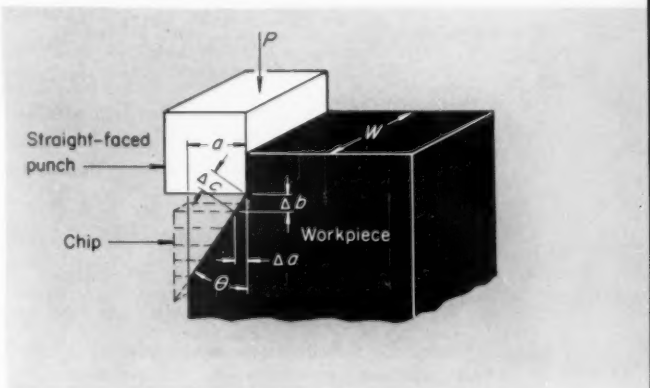


Fig. 1. Single chip formation with cutter of zero rake.

Nomenclature

D = Denominator in Equation 5
HP = Horsepower
K = Notation for the constant: $f_e + f_i - \tan \pm \alpha$
P = Cutting force tangential to surface of workpiece
P_n = Component of cutting force normal to shear surface of chip
P_t = Component of cutting force tangential to shear surface of chip
U_e = Energy of external friction between initial chip surface and tool face
U_i = Energy of internal friction between shear surface of chip and corresponding shear face of workpiece
U_s = Energy of deformation in separating a chip from the workpiece
V = Cutting speed, ipm
W = Work performed by external (cutting) force
a = Radially directed feed per revolution (feed rate)
b = Axial length of separated single shear chip
c = Length of shear chip along shear surface
f_e = Coefficient of external friction between initial face of chip and cutting tool
f_i = Coefficient of internal friction between shear surface of chip and corresponding shear surface of workpiece
p = Pressure of cutting tool on initial chip face, psi
w = Axial depth of cut (width of groove)
$\pm \alpha$ = True positive or negative rake angle of cutting tool
$\Delta a, \Delta b, \Delta c$ = Corresponding distances of displacement of a single shear chip in separating from workpiece
θ = Shear angle (inclination of surface to cutting direction)
τ = Ultimate shear strength of material to be cut.

the material of the workpiece along the shear surface of the same inclination repeats itself continuously so that the load P represents the cutting force for a given material machined at low speed by a cutter with zero rake angle. With these conditions in mind, an analysis of the cutting process based on a work-energy method has been developed.

Application of Work-Energy Method: Before starting with the analysis it should be mentioned that in groove cutting the load is directed radially while the width or depth of the groove is directed axially. In turning on a lathe the feed is directed axially, the width or depth of cut is directed radially. This difference does not change the basic relationship between cutting force, on the one side, and shearing strength of the material and shear angle, on the other side.

The work-energy method states that the work done by the external forces is equal to the energies into which it is transformed. This leads to the equation:

$$W = U_e + U_i + U_s \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

All symbols are defined in the nomenclature. With the geometrical conditions shown in *Fig.* 2, for positive rake angle the following equation applies:

$$W_+ = Pb' = pwa\ \Delta\ a\ (\text{cotan}\ \theta + \tan \alpha)$$

For negative rake angle, *Fig* 3, the equation is:

$$W_- = Pb' = pwa\ \Delta\ a\ (\text{cotan}\ \theta - \tan \alpha)$$

Combining the equations in one formula:

$$W = pwa\ \Delta\ a\ (\text{cotan}\ \theta + \tan \pm \alpha) \ldots\ldots\ldots\ldots (2)$$

The energies into which W is transformed are:

$$\left.\begin{aligned} U_e &= f_e\ P\ \Delta\ a = f_e\ pwa\ \Delta\ a \\ U_i &= f_i\ P_n\ \Delta\ c = f_i \frac{p \sin\theta\ \Delta\ a}{\sin\theta} = f_i\ pwa\ \Delta\ a \\ U_s &= \tau\ wc\ \Delta\ c = \frac{\tau\ wa}{\sin\theta}\left(\frac{\Delta\ a}{\sin\theta}\right) = \frac{\tau\ wa\ \Delta\ a}{\sin^2\theta} \end{aligned}\right\} \ldots (3)$$

By introducing the expressions 2 and 3 in Equation 1 and by some simple algebraic operations the following equation results:

$$p\left[\text{cotan}\ \theta - (f_e + f_i - \tan \pm \alpha)\right] = \frac{\tau}{\sin^2\theta} \ldots (4)$$

$$p = \frac{\tau}{\sin\theta \cos\theta - (f_e + f_i - \tan \pm \alpha)\ \sin^2\theta} = \frac{\tau}{D} \ldots (5)$$

The smallest value of p for which the ultimate shear strength τ is reached depends on a certain value of the shear angle θ, namely, that value for θ for which the denominator D is a maximum. This value of θ is found by zeroing the first derivative of D:

$$\frac{dD}{d\theta} = \frac{d}{d\theta}\left[\sin\theta \cos\theta - (f_e + f_i - \tan \pm \alpha)\ \sin^2\theta\right] = 0$$

By substituting for the constant $(f_e + f_i - \tan \pm \alpha)$ the notation K it follows that:

$$\cos 2\theta - K \sin 2\theta = 0$$

$$K = \text{cotan}\ 2\theta = f_e + f_i - \tan \pm \alpha \ldots\ldots\ldots (6)$$

Equation 6 defines the dependency of the shear angle θ on the external friction, the internal friction, and the true rake angle of the cutting tool. By substituting in the denominator D of Equation 5 the expression 6, it is seen that:

$$D = \sin\theta \cos\theta - \text{cotan}\ 2\theta \sin^2\theta = \frac{1}{2\ \text{cotan}\ \theta}$$

$$p = \frac{\tau}{D} = 2\ \tau\ \text{cotan}\ \theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Stating Equation 7 in words: the cutting force per square inch of the initial chip section equals two times the shear strength of the material to be cut multiplied by the cotangent of the shear angle.

Assuming that the cutting force $P = pwa$ remains approximately constant, the work per minute (W_m) will be: $W_m = pwaV = 2\ waV\ \tau\ \text{cotan}\ \theta$, in-lb/min. In this equation, waV is the chip volume cut per minute. For the unit volume of one cubic inch per minute (W_c) it follows that $W_c = 2\tau\ \text{cotan}\ \theta$, in-lb/min.

Substituting horsepower for inch-pounds per minute ($HP = 396{,}000$ in-lb/min.), the work required to cut one cubic inch per minute (W_1) is:

$$W_1 = \frac{2\ \tau\ \text{cotan}\ \theta}{396000} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

To give an example: For 24-St-4 aluminum alloy with a shear strength of about 40,000 psi, static tests with a straight punch (zero rake angle) showed that the shear angle θ was close to 30 deg. According to Equation 7, the unit cutting force (psi) would be:

$$p = 2\ \tau\ \text{cotan}\ \theta = 2\ (40000)\ (1.73) = 138000$$

and, according to Equation 8, the required horsepower would be:

$$W_1 = \frac{2\ \tau\ \text{cotan}\ \theta}{396000} = \frac{138000}{396000} = 0.35$$

For cutting an 0.100-inch-wide groove with an 0.003-ipr feed rate and 960-ipm speed, $P = (138{,}000)\ (0.100)\ (0.003) = 41$ lb and $W_m = (0.35)\ (0.100)\ (0.003)\ (960) = 0.1$ hp.

Influence of Rake Angles: According to Equations 7 and 8, cutting force and horsepower are proportional to the cotangent of the shear angle θ. If cotan θ is expressed by cotan 2 θ according to the trigonometric formula

$$\text{cotan}\ \theta = \text{cotan}\ 2\ \theta + \sqrt{1 + (\text{cotan}\ 2\ \theta)^2}$$

and the value of cotan 2 θ is substituted from Equation 6:

$$\text{cotan}\ \theta = f_e + f_i - \tan \pm \alpha + \sqrt{1 + (f_e + f_i - \tan \pm \alpha)^2} \quad \ldots\ldots\ldots (9)$$

Using appropriate subscripts for zero rake angle, positive rake angle and negative rake angle, Equation 9 can be split into three single equations:

$$\text{cotan}\ \theta_o = f_e + f_i + \sqrt{1 + (f_e + f_i)^2}$$

$$\text{cotan}\ \theta_+ = f_e + f_i - \tan\ \alpha + \sqrt{1 + (f_e + f_i - \tan\ \alpha)^2}$$

$$\text{cotan}\ \theta_- = f_e + f_i + \tan\ \alpha + \sqrt{1 + (f_e + f_i + \tan\ \alpha)^2}$$

The accompanying table for the proportional factor cotan θ of cutting force and horsepower is calculated with a value $f_e + f_i = 0.6$, corresponding to a shear angle between 29 and 30 deg as tested for 24-St-4 aluminum alloy. *Fig.* 4 illustrates diagrammatically, with α as abscissa and cotan θ as ordinate, the dependency between both values for $f_e + f_i = 0.6$ (middle curve) and for $f_e + f_i = 0$ (lower curve) as well as $f_e + f_i = 1$ (upper curve). The curves illustrate the rapid increase of cutting force and horsepower for larger negative rake

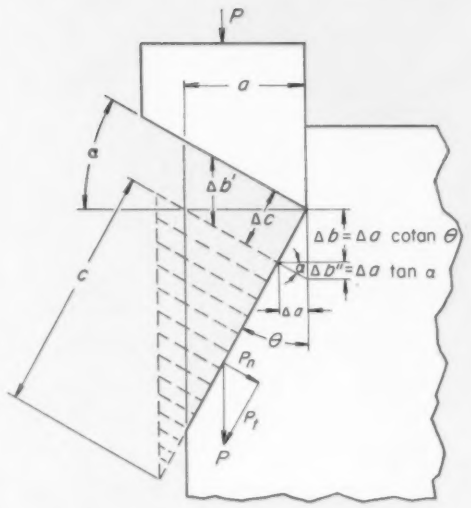


Fig. 2. Single chip formation with cutter of positive rake angle α.

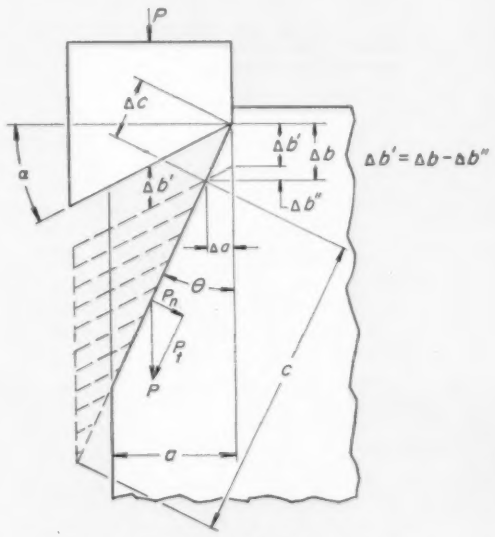


Fig. 3. Single chip formation with cutter of negative rake angle α.

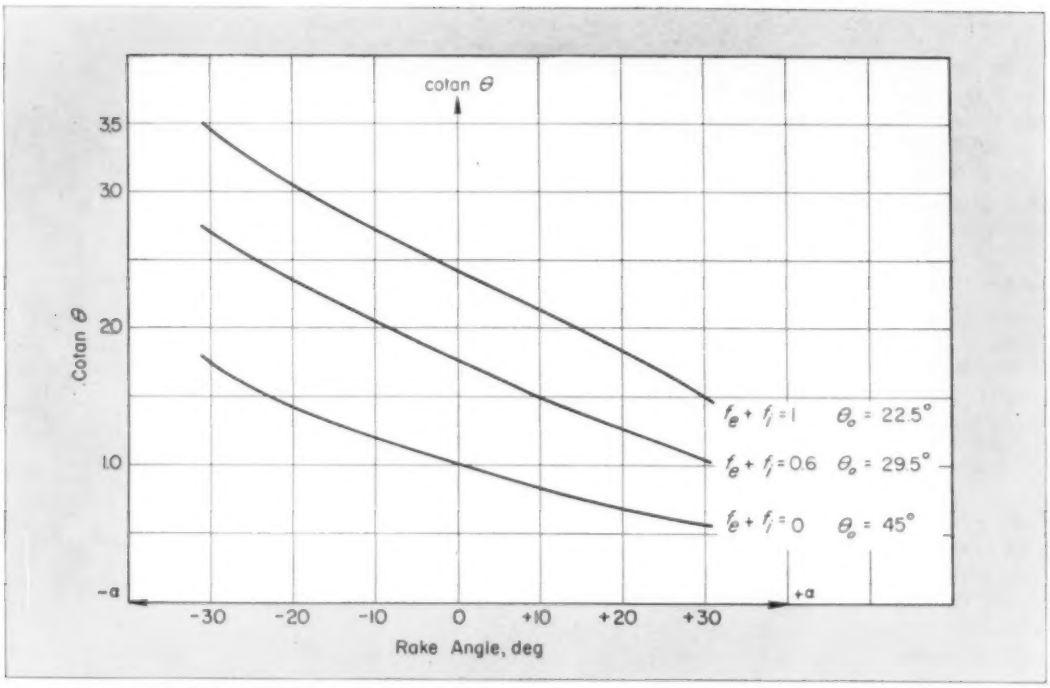


Fig. 4. Dependency of cotan θ (factor of proportionality for cutting force and horsepower) on true rake angle α of cutting tool.

Table for $f_e + f_i = 0.6$ or $\theta_o = 29.5$ deg

α (deg)	tan α	cotan θ_- / cotan θ_+	cotan θ_- / cotan θ_+	Increase of cotan θ_- over cotan θ_+ (%)
− 31	−0.6	2.76	2.76	176
+ 31	0.6	1		
− 22	−0.4	2.41	1.97	97
+ 22	0.4	1.22		
− 11 1/3	−0.2	2.1	1.41	41
+ 11 1/3	0.2	1.48		
− 6	−0.1	1.95	1.21	21
+ 6	0.1	1.6		
− 0	0	1.77	1	0
+ 0	0	1.77		

angles and the corresponding decrease for positive rake angles.

From the foregoing, it is obvious that cutting force and horsepower for machining operations can be calculated for any material for which the shear angle and the ultimate shear strength of the material are known. The cutting force per square inch of the initial chip section is proportional to the contangent of the shear angle and the ultimate shear strength of the material to be cut. The same holds true for the horsepower required to cut one cubic inch of material per minute. The cotangent of twice the shear angle equals the sum of the coefficient of external friction and the coefficient of internal friction minus the tangent of the true rake angle of the tool.

Electron Beam Machining

HOLES AND SLOTS as small as 0.0008 inch can be cut in the hardest materials by using the electron-beam process. In this process, developed by the Carl Zeiss Foundation of West Germany, a controlled, high-density stream of electrons is used to change matter physically or chemically.

An electron gun develops a precisely controlled beam of electrons that can be directed to do work on a target. The target material is heated, melted or vaporized according to the level of energy density in the beam.

The target is mounted on a worktable and is enclosed within a vacuum chamber. An electronic control system manipulates the electronic deflectors and lenses that control the size and programming of the beam.

Energy density during drilling runs as high as the equivalent of 600 million watts per square inch. Even higher energy and density and much smaller holes and slots are contemplated in the near future.

North American rights to the process are held by Hamilton Standard, a division of United Aircraft Corp. Hamilton-Electrona, Inc., 40 Wall Street New York City, will handle sales.

AIR provides feedback signal *for blind drilling*

Automatic control of drilling operations on a transmission case looked unfeasible because difficult operating conditions seemed to eliminate the possibility of obtaining adequate protection. Ingenuity found that air testing could provide the necessary feedback signal.

In designing a unit for the machining of transmission cases, Cross Co. engineers encountered some unusual problems in obtaining the feedback essential to the automatic control of the machining head shown in *Fig.* 1. The feedback device required had to be rapid in operation and highly accurate in performance. Space available for it was extremely limited. Also, the environment was unsuitable for electrical circuitry. So with ingenuity, they turned to a quite different method—air testing. Air conveys the feedback signal needed for the automatic control of the drilling cycle.

Operation: From opposite sides of the transmission case, two drills move in to cut pivot pin holes. Each drill actually cuts two aligned holes. The smaller drill, 0.38 inches in diameter, first cuts through 1.32 inches of the outer wall and then cuts 0.5 inches into a shoulder. The larger drill, 0.501 inches in diameter, cuts first through 0.96 inches of wall and then 1.2 inches into a shoulder.

Since precise alignment between the outside and inside holes is essential, the bushing plates must be positioned with a high degree of accuracy inside the casting to guide the drills for the inner holes. Position of the bushing guides, with the drills at the end of the cut is shown in *Fig.* 2, where the

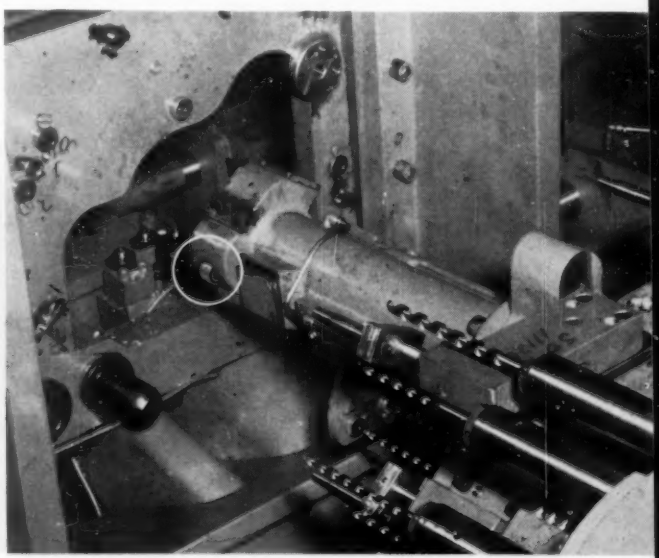


Fig. 1. Machining head in premachining position, bushing plates in retracted position.

Fig. 3. (right) Seen from inside the casting, the bushing plates are fully extended.

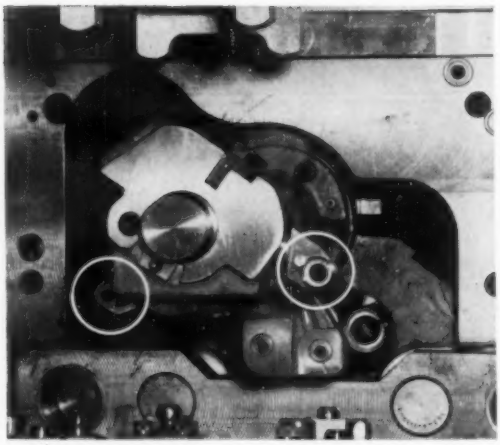
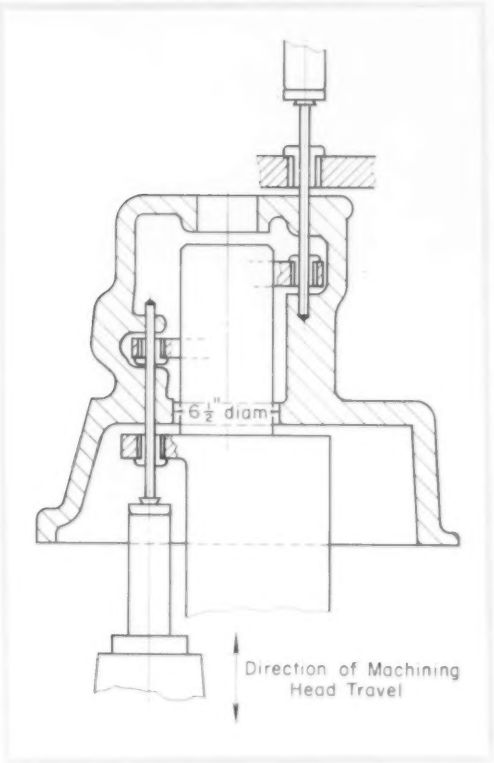


Fig. 2. Transmission housing, with guided drills at end of stroke.



additional complications of the job are also evident. The bushing plates enter the casting through a hole only 6.5 inches in diameter, extend to guide the drills, and then retract after drilling is completed to permit the plate to exit through the 6.5 inch opening.

Control Problem: Because of the blind location of the inner holes, some method is needed to determine when the bushing plates are positioned after they are extended within the housing. A tiny chip of metal in the way, or a small bump on the internal surface of the casting might cause the inner hole to be drilled out of line. Timing is critical too, for the feedback signal must occur quickly before the inner holes are started.

The narrow entry and exit space severely limits the size of the feed-back device. Coolant splashing about during drilling makes the use of electrical circuits inadvisable. But air testing conveys a rapid and accurate feedback signal and meets the difficult environmental situation well.

Air Testing System: An air passage runs longitudinally through the bushing plate body to the cylindrical shaped bushing holders. As the machining cycle starts, air pressure at about 40 psi is admitted to the passage and allowed to escape through a small orifice in each bushing holder.

When the bushing plate body is located in the transmission casting, the bushing holders are hydraulically extended into position, as shown in *Fig.* 3. At full extension, they block each orifice, cutting off the escaping air. Back pressure through the compressed air circuit then actuates a pressure switch and permits drilling to begin. If for some reason either of the two bushing holders fails to reach full extension, the air continues to escape and drilling is inhibited.

After drilling is completed, the bushing holders retract into the bushing plate body. The air test circuit indicates whether the bushing holders are completely retracted as they must be to clear the part as the bushing plate body withdraws through the 6.5 inch opening.

The complete cycle—advancing the heads, machining, and returning the heads — requires 72 seconds for the small hole, and 44 seconds for the large hole, including air test.

"I can't decide what the control should decide."

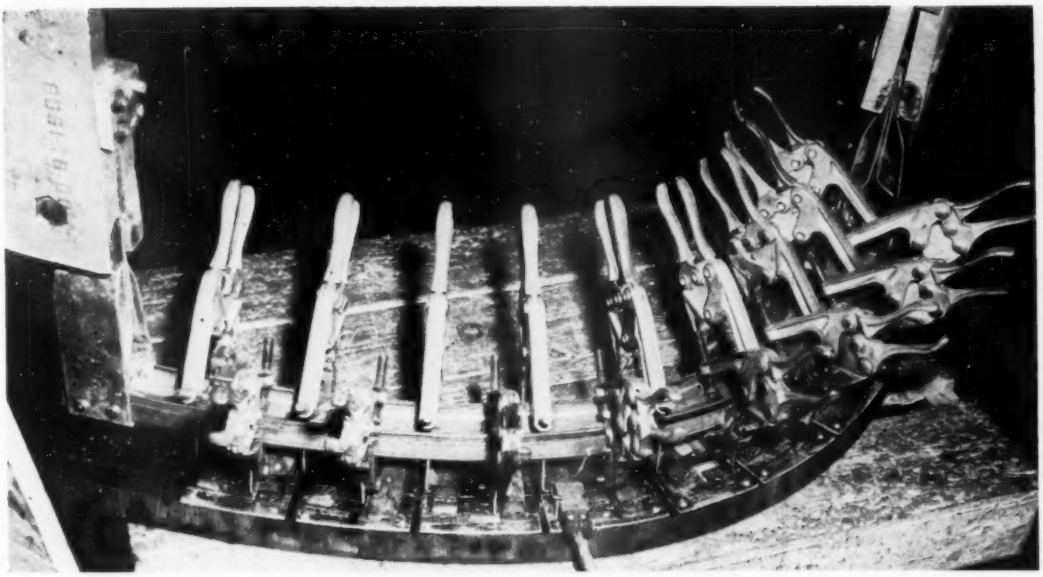


Fig. 1. Fixture for final forming of titanium part. Dies are resistance heated, forming is at 1000 F.

Forming Titanium

with resistance-heated dies

By Richard Ludwig
Manufacturing Research Engineering Dept.
Chance Vought Aircraft, Inc.
Dallas, Texas

Creep forming of aircraft parts has been made more efficient by using resistance-heated stainless-steel dies. Details of die construction and production results are discussed by the author, with illustrations.

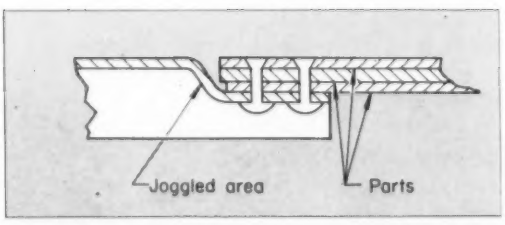


Fig. 2. Sheet-metal aircraft parts are joggled to maintain a smooth outer surface.

With the advent of Space-Age materials, a number of new forming methods have been developed. One of these is creep forming, where sheet-metal parts are formed between dies heated to high temperatures. This forming method makes it possible to shape titanium and other brittle materials without tearing or springback. The method is described in detail in: "Forming High-Strength Materials," The Tool Engineer, August 1958.

Creep forming has been in use for several years. As the range of applications has been extended, there has been a continuous effort to improve die heating methods and to develop improved tools and tooling. One product of this effort has been the development of a final forming fixture that utilizes the resistance heating method to final form and joggle titanium parts, *Fig.* 1. A joggled part is shown in *Fig.* 2.

There are three basic considerations in designing the fixture: it must produce quality parts, it must be economical to construct and it must be capable of withstanding temperatures of 1200 F and above. The resulting fixture consists of two stainless-steel die halves identical to the part they will form. One

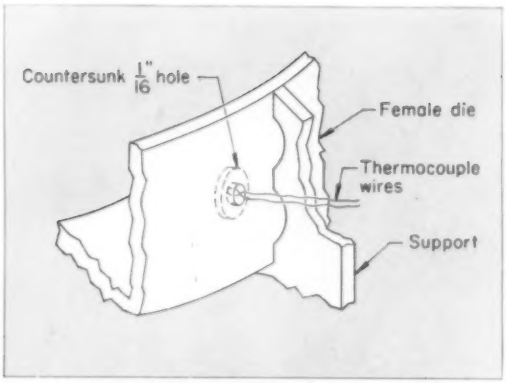


Fig. 3. Method of connecting thermocouple wires.

die half is held to contour on a compreg base by means of stainless-steel supports, while the mating half is held in place by hand clamps. A titanium part to be final-formed is pressure-clamped between the dies. Current is then passed through the dies, heating them to the required forming temperature.

Tool Design: The three most commonly used part cross-sections for aircraft construction are angle, Z-sections and C-sections. Resistance-heated dies for each type of section were constructed to test the feasibility of resistance heating. Since the angle section is the easiest of the three sections to form, a fixture was designed and constructed for an angle section part first. The part selected for forming was a typical production part of 4908 titanium, 0.025 inch thick. Flange height was 3/4 inch; web width was also 3/4 inch; radius of curvature was 20 inches; length was 60 inches and the joggle was 3/16 inch deep.

Stainless steel, 0.090 inch thick, was selected as the die material. This material has several advantages as a creep forming die material. It is easy to form in the annealed condition, has excellent scale resistance to 1600 F, is easily welded and retains approximately 40 percent of its strength at 1200 F.

A conventional press brake was used to form the male and female stainless-steel die cross sections. The contour was produced in the dies on a standard compreg stretch die mounted on a stretch press. Joggles were formed by hand. Normalizing the stainless-steel dies eliminated any later changes in length after the dies were in use. Treatment at 1400 F for five minutes, followed by air cooling, was found adequate for normalizing.

Due to the difference in expansion between the stainless-steel dies and the titanium part during heating, it was necessary to shorten the die distance between the joggles. The allowance was 0.046 inch per foot of die length from joggle to joggle.

In the completed die, aluminum conductor tabs are secured to each end of the male and female dies by stainless-steel bolts. The tabs act as cooling fins to reduce heat transfer back into the electrical cables. They are easily flattened, giving a good clamping surface for the electrode clamps.

A high-resistance, permanent-magnet moving-coil millivoltmeter, connected to a thermocouple, is used to read die temperatures. Accuracy of temperature readings is dependent on the method of connecting the thermocouple to the die. The method shown in *Fig.* 3 gives good results. A 1/16-inch hole was drilled through the female die and countersunk from the forming face side of the die. The thermocouple wire was twisted once and inserted through the hole with its end in contact with the part. Eutectic type filler rod was flowed into the countersunk hole to secure the wire.

The fixture base is constructed from two one-inch thick sheets of compreg, bolted together. Since clamping pressure is applied to the angle die flange at an angle of 45 degrees, the inner contour radius side of the base is cut on a 45-degree angle for mounting the clamps, *Fig.* 4.

To meet temperature and strength requirements, die supports are of 0.090 inch thick stainless steel. These supports are welded to the die on four-inch

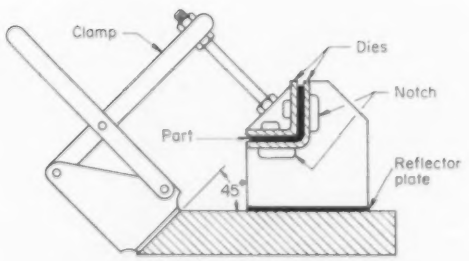


Fig. 4. Fixture design for creep forming angle-section parts.

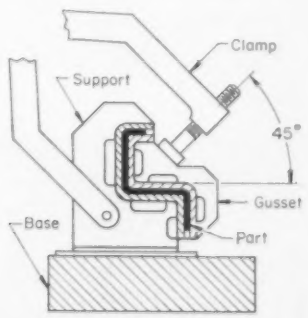


Fig. 5 Fixture design for forming Z-section parts.

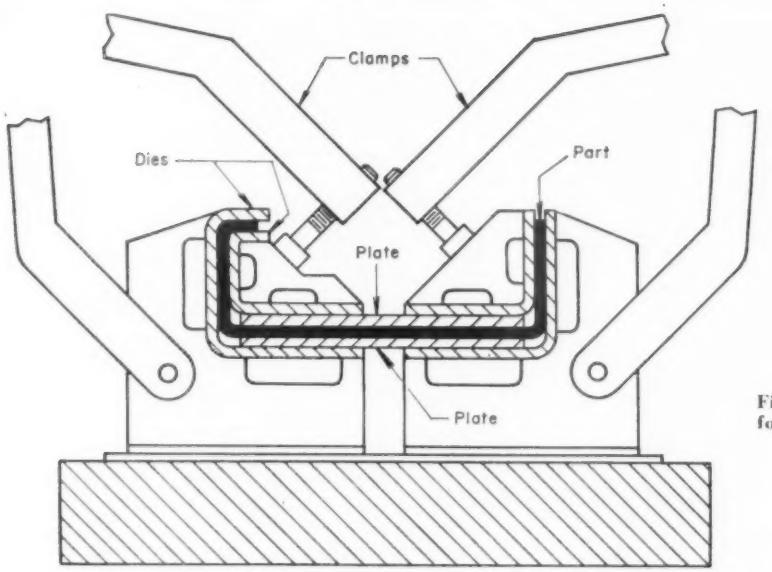


Fig. 6. Fixture design for forming C-section parts.

centers around the die contour. Aluminum reflector plates are secured to the top of the compreg base, providing a bearing and reflecting heat.

The stainless-steel dies expand and contract due to temperature changes. Accordingly, only the center die support is bolted to the base. Both sides of the die are free to float. The dies are guided to the proper contour and held down by lugs.

Gussets provide cross-sectional strength for the male die and a bearing for the clamps. These are welded onto the male die at points corresponding to the centers of the supports on the female die.

Design of the Z-section and C-section fixtures is shown in *Figs.* 5 and 6. Basically, the Z-section fixture is the same as the angle section fixture except that the clamps are allowed to float with the dies. This improvement resulted from production experience with the angle section fixture.

When C-section parts are cold-formed, contour springback, longitudinal twist and nonuniform part widths are common. This could have caused difficulty when inserting the part in the hot-form die. To avoid difficulty in loading, both dies are split longitudinally, allowing die width to be adjustable. The dies are allowed to float, permitting longitudinal expansion and contraction. To create adequate support for the part, stainless-steel plates are inserted above and below the part prior to forming.

Operating Procedure: Die heating is accomplished with a 100 kva resistance-heating machine. The machine has a thyratron type controller with a saturable-core reactor.

During testing, the operating procedure for each die is the same. A 4908 titanium part is clamped in the die to be tested. Electrical cables are connected to the die and the heating unit is set to maintain a die temperature of 1000 F. Once the die reaches the required temperature, the temperature is maintained for three minutes to creep form the part. Removing the part before cooling results in a deformed part so the die is allowed to cool to 800 F before the formed part is removed.

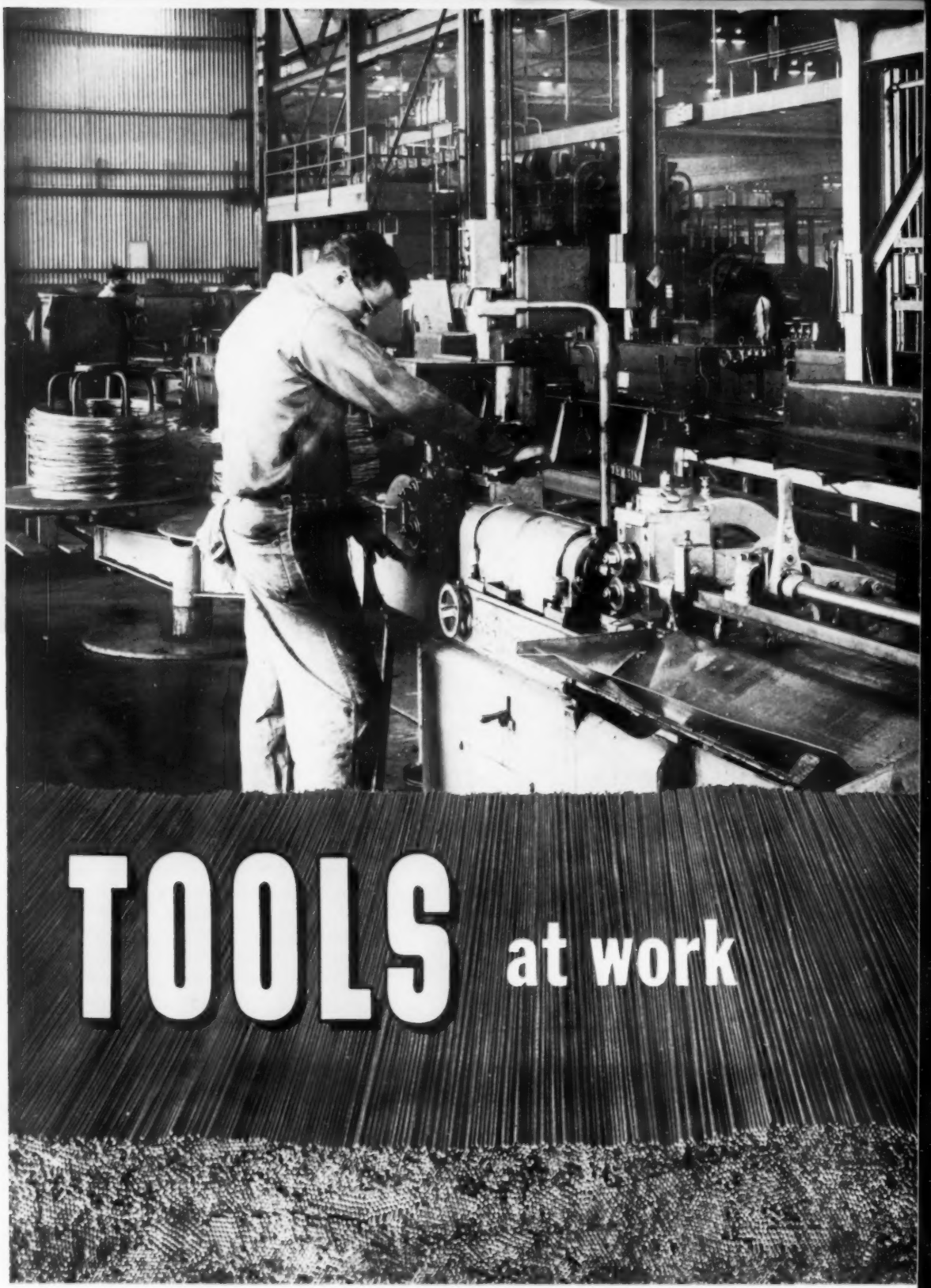
Results: All three fixtures proved satisfactory for physical strength. There was no noticeable scaling of the dies at temperatures to 1200 F. Even when the dies were at 1200 F, the aluminum reflector plates remained at 200 F or lower.

No trouble was encountered when loading or unloading parts. Good joggles were formed in all parts due to the fact that the joggles are formed at high temperatures and also because the forming pressure is normal to the joggle area.

Parts produced in the fixtures had satisfactory contours and cross sections. They fit without clearance when placed back in the dies after forming.

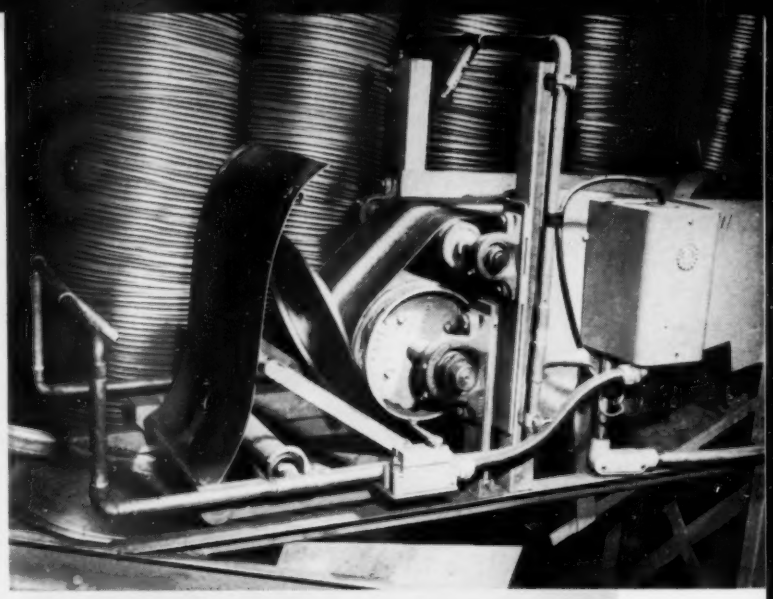
Satisfactory results with the test fixtures led to the adoption of resistance-heated dies for production applications, subject to two limitations: Maximum metal thickness should be not more than 0.040 inch and maximum flange height should be 1½ inches.

Three-minute creep forming times are standard. Forming temperatures for various titanium materials are as follows: for 4901, 600 F; for 4908, 950-1050 F; for 6A1-4V, 1150-1200 F. The excellent production results obtained illustrate once again the value of applied research in manufacturing.

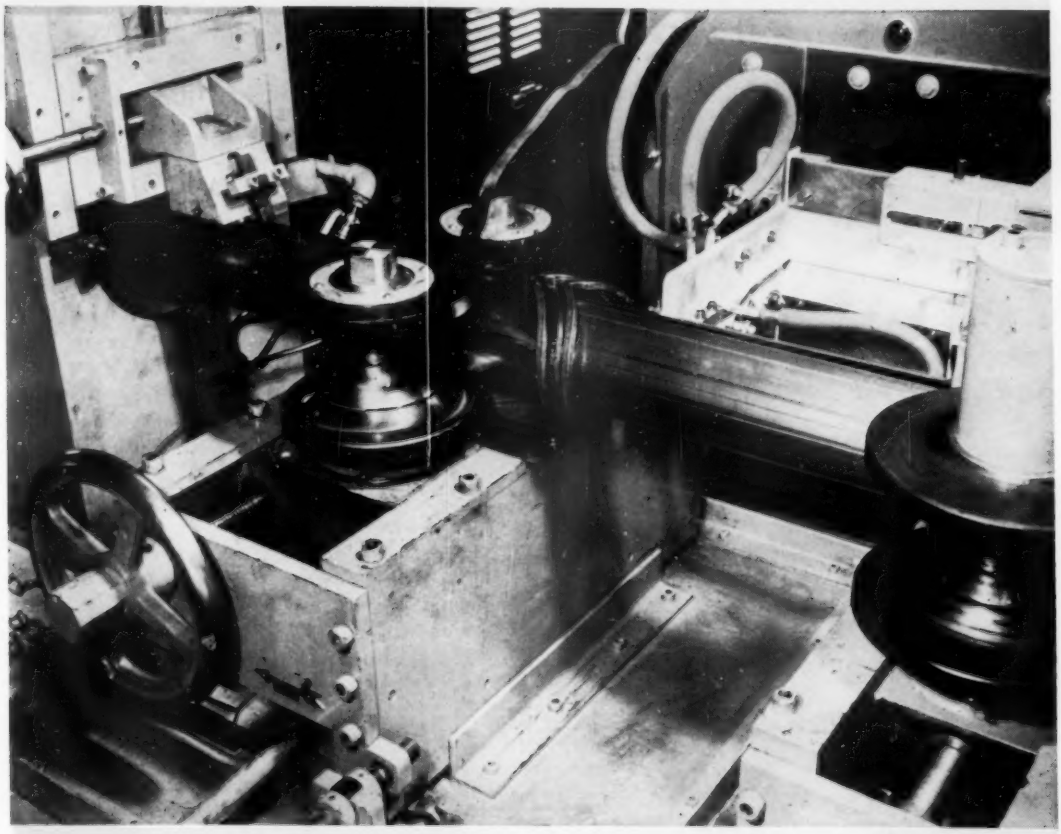


TOOLS at work

BRONZE WELDING ROD, fed from coils, is automatically straightened and cut to length at Titan Metal Mfg. Co., Div. of Cerro de Pasco Corp. After cutting, rods are cleaned in an acid bath and packed for shipment.

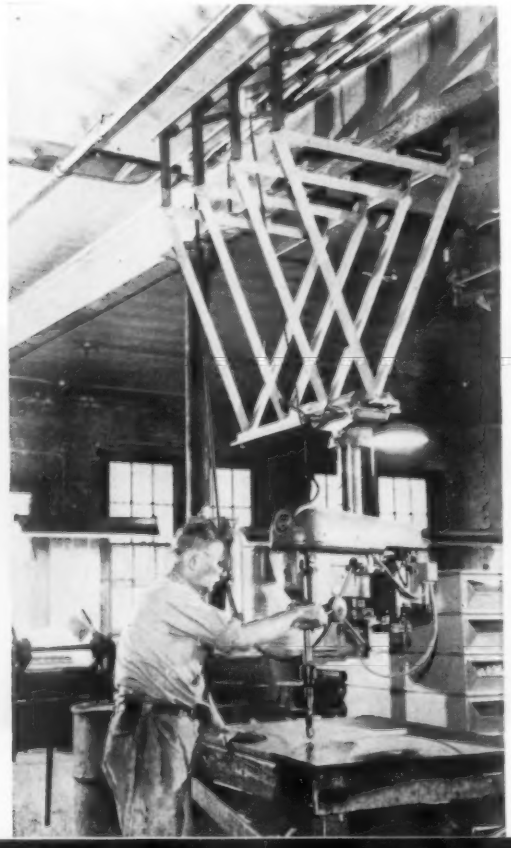


AFTER LEAVING a lacquering station, bottoms for five-gallon pails are flipped to present the other side for processing by means of an Eriez magnetic pulley at the end of the conveyor line. When required, standing metal piece may be lowered to create a bypass so that lids or bottoms do not turn over. Line is in operation at Inland Steel container plant.



THIN-WALLED STOCK IS WELDED by high frequency induction into 4-inch tubing for mufflers on a Gordon & Morgan tube mill. A multiple turn hairpin type work coil induces a current that brings the abutting edges up to forging temperature. Current at 400 kc is provided by a generator built by Induction Heating Corp. Heat penetration is 0.025 inch. Welding is at a speed of 100 fpm.

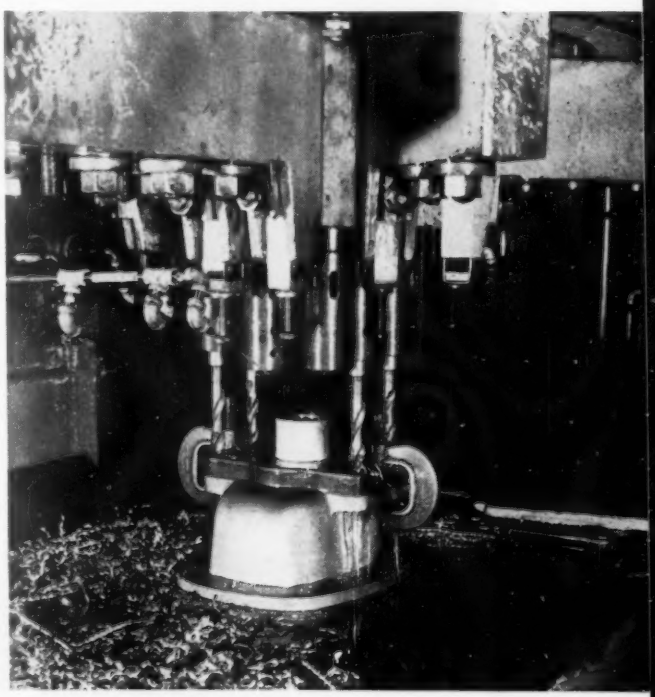
ROTARY WHEEL replaces standard assembly line work bench in assembling small missile electrical and electronic components at The Martin Co.'s Baltimore Div. Wheel has 24 assembly positions and automatically rotates clockwise at a predetermined rate as three operators, working as a team, assemble components. Power-operated rotary switch permits remote control of special electrical circuits for stepping, counting and selecting.



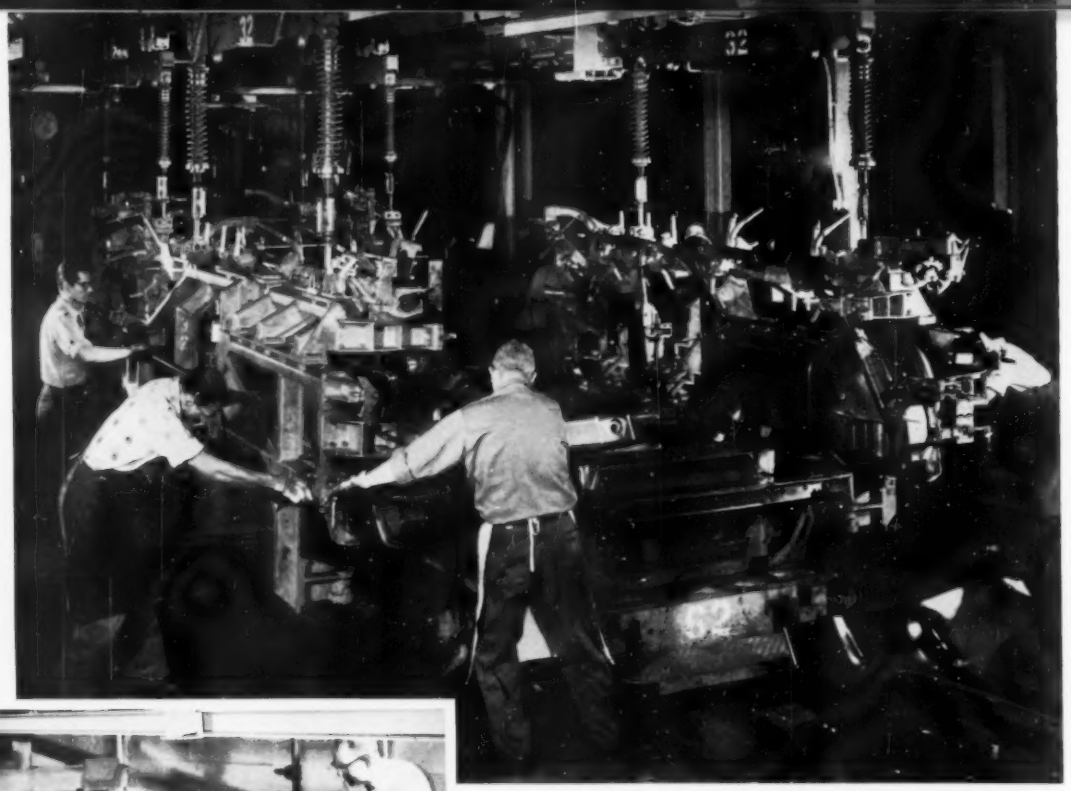
EBONY ASBESTOS PANELS too large for a conventional drill press are processed on a standard Delta overhead drill press at Electric Box and Switchboard Co. The tool can reach to any point within 10 inches of either side of the 40-inch track on which it is mounted. Worktable is on casters.

TWO STAMPING OPERATIONS ARE COMBINED on this 400-ton press at American Stamping Co. Automotive brake-mounting backing plates are shown here being stamped from Jones & Laughlin 1046 hot rolled steel sheets. At right, the blanking and first forming operation is done on one set of dies. The plates are then placed manually onto the second die at left, where the second forming operation is performed.

TOOLS at work

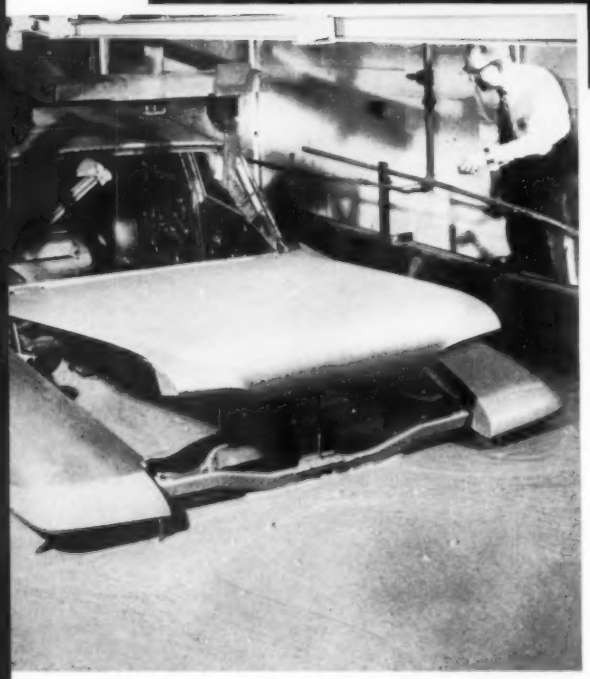


BUSHING PLATE, clamped to workpiece, suffices for fixture on this multiple spindle operation of drilling a hole pattern in valve body flange. The drilling machine, a Natco C3B, through the application of hydraulic pressure exerted on the drills, provides for location, alignment and part holding.

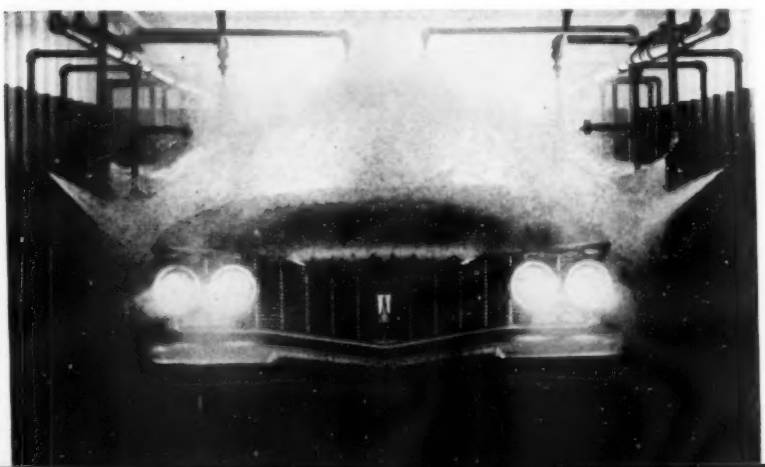


UNITIZED BODY CONSTRUCTION at the Plymouth Detroit Assembly Plant is accomplished with the aid of gate fixtures. At the start of the main gate line, side parts of the car body are placed in fixtures, the fixtures are swung into position and clamped to the floor pan, and the body is welded with spot welding guns.

TOOLS at work



AT THE SEVENTH STAGE of rust proofing immersion process at Plymouth, a car body eases into a four-ft deep tank of anti-corrosive solution. The dip paint operation consists of six spray cleaning operations, a seven stage immersion rust-proofing operation, and a final seven-step finishing paint process.



WATER TESTING climaxes weather proofing operations on a 1960 Plymouth. Sprays direct 280 gpm of water at 30 psi for four minutes on each car.

developing cam system charts for optimum performance

By Werner Vogt*
Chief Development Engineer
Machine Div.
The Torrington Mfg. Co.
Torrington, Conn.

Well-balanced cam systems are essential to the proper performance of four-slides screw machines and most automatic machinery. Optimum cam systems can be designed using a graphical method described by the author.

MAXIMUM OUTPUT RATE without danger of failure in cam-driven machines can be realized only when the cams have been designed specifically to meet the requirements of each forming sequence. A key step in achieving optimum performance is to coordinate the required operation within the total cam cycle available so that the cam system as a whole is well balanced.

The logical way to plan a camming sequence in advance is to prepare schematic cam charts, in which the beginning and end of every motion is recorded. Relationships among all motions at any given time of the cycle are readily seen and interferences can be detected before the cams are cut. A cam chart is thus a convenient means for recording motions and predicting cam performance so as to permit cutting of the cams in advance. However, chart layout is usually considered too involved and time-consuming, so cam charts are seldom used consistently.

A cam system can be viewed as a chain, the links being the successive motions. As a chain is only as strong as its weakest link, so also a cam system will probably fail first—and prematurely—at the poorly designed cam. A well-balanced cam system, on the other hand, prevents excessive wear or even breakage in the cam follower system, increases load capacity, permits higher production speeds, and reduces noise and vibration.

This article describes a logical step-by-step procedure for designing a well-balanced system. Based on graphical methods, the procedure replaces tedious calculations with the simple application of a straightedge and pencil. The accuracy is sufficient for all practical purposes, since at least one or two degrees are normally allowed between successive motions.

As a workable rule-of-thumb for slow to medium-speed cam systems (in four-slides, screw machines and most automatic machinery), a maximum pressure angle of 30 degrees will be arbitrarily assumed. Without such a limitation, too steep a pressure angle can cause broken pins and slides by making the cam system self-locking. Acceleration forces, which are usually small enough in this speed range to be disregarded, are not considered in order to keep the procedure simple and practical.

The following example, dimensions and the part itself are hypothetical, designed to fit the layout of the cam chart most conveniently and to show how to adjust the forming action until the desired degree of balance is attained. A short discussion of cams is presented first, primarily as background on the cam shapes used in the graphs.

Types of Cams: Three types of simple cams are widely used because they are easy to lay out and machine: straight-line cams, straight-line circular arc cams and simple harmonic cams. The displacement diagram in *Fig.* 1 compares each of

*Senior member ASTME Central Connecticut chapter.

these cams for an identical cam stroke, h, and angle of cam rise $\beta = 150$ degrees. Many more cam profiles have been developed, such as the cycloidal, trapezoidal or constant-torque types. They are designed for high speeds or special effects. The high precision required in their manufacture limits their general use at present by those who cut their own cams in the plant.

Straight-Line Cams: The straight-line cam is simply a straight line throughout the stroke, with a constant pressure angle. Since a straight line is the shortest distance between two points, the straight-line cam requires the least cam angle for a given displacement, so that it is the smallest cam possible. The abrupt change in profile at the beginning ($\beta = 0$ degree) and end of the stroke ($\beta = 150$ degrees) causes destructive shock loads, limiting the straight-line cam to hand-driven machinery and crawling speeds only.

Straight-Line Circular-Arc Cams: The straight-line circular-arc cam is designed to reduce the shock loads occurring in the straight-line cam by modifying the stroke ends with tangential circular arcs. The radius of the arc is usually made equal to the maximum stroke (h). This cam type is frequently used because it is easily produced on a common milling machine. Unfortunately, the shock on the ends of the cam stroke is too high for production speeds. With straight-line circular-arc cams, widely used in four-slide machines, failure of slides and cam roll follower pins can often be traced to inherent shock loads rather than to failure in the material.

Simple Harmonic Cams: The profile of a simple harmonic cam is continuously curved throughout the stroke. The maximum pressure angle occurs at the midstroke (at $\beta = 75$ degrees in *Fig.* 1) gradually falling to zero at both the beginning and end of the stroke. The gradual change in pressure angle and the corresponding smooth harmonic path of the acceleration results in substantially reduced shock, vibration and noise. The simple harmonic cam is well qualified for the speed range normally encountered in many cam-driven machines for such operations as forming, indexing, and feeding, and perhaps is the most frequently used cam type at present. In a particular cam shape—rise, no-dwell, fall, as in quick striking and knockout motions—the simple harmonic cam excels or equals any other known cam shape.

Cam Layout: The layout of a simple harmonic cam is demonstrated in *Fig.* 2. A semicircle is divided in six equal parts. Similarly, the cam angle is divided in six equal parts. The connecting points 1-1, 2-2, up to 6-6 lie on the simple harmonic curve. Of course, more than six points must be located in laying out a template for an actual cam. A layout ratio of 10:1 or often 100:1, with at least five-degree steps from point to point, is necessary to produce a sufficiently accurate curve for satisfactory results. Although this procedure seems elaborate and unnecessary, actual tests* have shown that variations as small as a few thousandths of an inch from the theoretical cam shape have resulted in excessive wear, pitting, vibration and noise. With some practice, an enlarged layout takes no more than 15 or 20 minutes. The cam shape need be developed only to the midpoint, since the return is a mirror image of the forward stroke.

A still simpler method is to use already computed cam tables† which most often progress from degree to degree over a 120-degree total, usually for a one-inch cam rise. For example, with a 12-degree cam and a ½-inch rise, every tenth figure from the chart is selected and halved. A possible drawback of cam tables is that only cam angles that are proportional to 120 degrees in relatively small

*See Rothbart, Harold A.—*Cams—Design, Dynamics and Accuracy*. John Wiley & Sons Inc., New York, 1956.

†See Kloomok, Martin and Robert V. Muttley—"Plate Cam Design," *Product Engineering*, Feb. 1955.

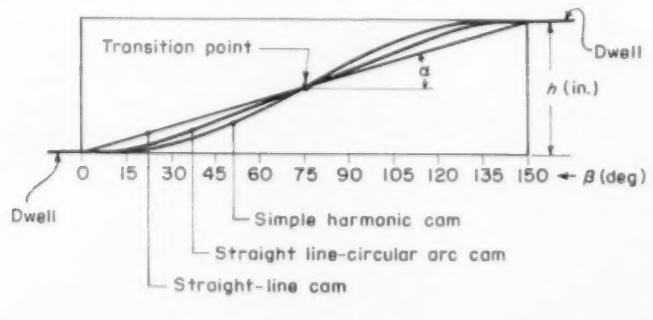


Fig. 1. Displacement diagram comparing three widely used types of simple cams.

whole numbers can conveniently be used. For instance, the cam angle $\beta = 32$ degrees (used in an example that will be discussed later in this article) is satisfactory since $32/120 = 4/15$ while $\beta = 34$ degree would be difficult ($34/120 = 17/60$ is not a convenient proportion). In practice, however, the cam angles chosen are rounded to the nearest angle proportional to 120 degrees. In the example, 41 degrees is reduced to 40 degrees and 87 degrees is raised to 90 degrees.

Relative Behavior of Cams: In order to compare the behavior of the three simple cam shapes, laboratory tests of each were conducted under identical conditions (equal pressure angle, stroke, distance of cam roll to cam center).

Limiting speeds were observed at about 20 to 30 rpm for the straight-line cam and 100 rpm for the straight-line circular-arc cam. At 330 rpm, the limiting speed of the test machine itself, the simple harmonic cam showed somewhat increased noise, but otherwise functioned so well that this speed was clearly not the limit for the chosen cam configurations. It should be noted that these limiting speeds, determined solely on the basis of noise level and apparent stress on the system and not by any actual strain measurement, are given only for rough comparison. Under different conditions the relative behavior of the cams might change considerably.

A speed ratio of 1:3:9 provides a useful approximation for the comparable speeds of straight-line, straight-line circular-arc, and simple harmonic cams under similar conditions. The time required to produce these three cams will differ in about the same proportions, with the simple harmonic cam taking at least ten times as long to machine as the straight-line cam. It would be interesting to extend these preliminary tests to millions of cycles in order to study the influence of the different cam types on the fatigue behavior of the cam system. The results would probably shift much more in favor of the simple harmonic cam.

Pressure Angle: The assumed pressure angle of 30 degrees is derived from actual experience and includes an ample margin of safety before self-locking of the cam system will occur. Larger pressure angles may occasionally be adopted when absolutely necessary if the operating conditions are such that it can be done safely. For instance, a side cam on one vertical four-slide machine operates with a pressure angle of 46 degrees at a speed of 220 rpm quite satisfactorily.

Among other reasons, the possibility of self-locking in a cam system becomes smaller as: (1) the friction in the follower slide is reduced; (2) the overhang of the unsupported slide portion adjacent to the cam becomes smaller; (3) the pressure angle drops, and (4) the cam surface becomes smoother. An excessive load on the overhanging slide portion, poorly lubricated or too tightly fitted slides, and poorly designed or manufactured cams can lead to self-locking. A worn-out slide will also increase the possibility of self-locking by actually tilting away from the resultant cam forces and thereby increasing the original pressure angle.

The rise angle β for each type of cam is given by the equation

$$\beta = \frac{180\, fh}{R_p} \qquad (1)$$

where h = maximum stroke (inches), R_p = distance from the center of the cam roll to the cam axis at half stroke (inches), and f = cam factor. The dimensions β, h and R_p are graphically defined in the drawing at the top of *Fig.* 7.

Cam factor f is given as a function of cam pressure angle α in the tilted graph at the right in NOMOGRAPH 1 for the straight line, straight-line circular-arc, and simple harmonic cams (curves are derived from Rothbart's treatment). The graph shows that for any given cam pressure angle, such as 30 degrees, the cam factor for a straight line cam is smaller than that for a simple harmonic cam. Thus, as stated in regard to *Fig.* 1, Equation 1 shows that rise angle β will always be smaller for a straight line cam for

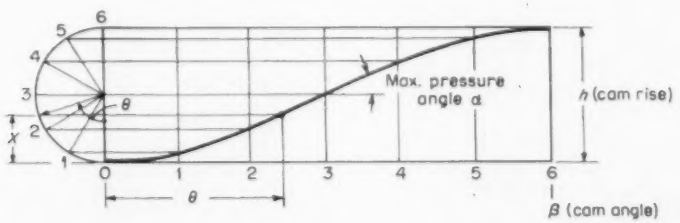


Fig. 2. Layout of a simple harmonic cam.

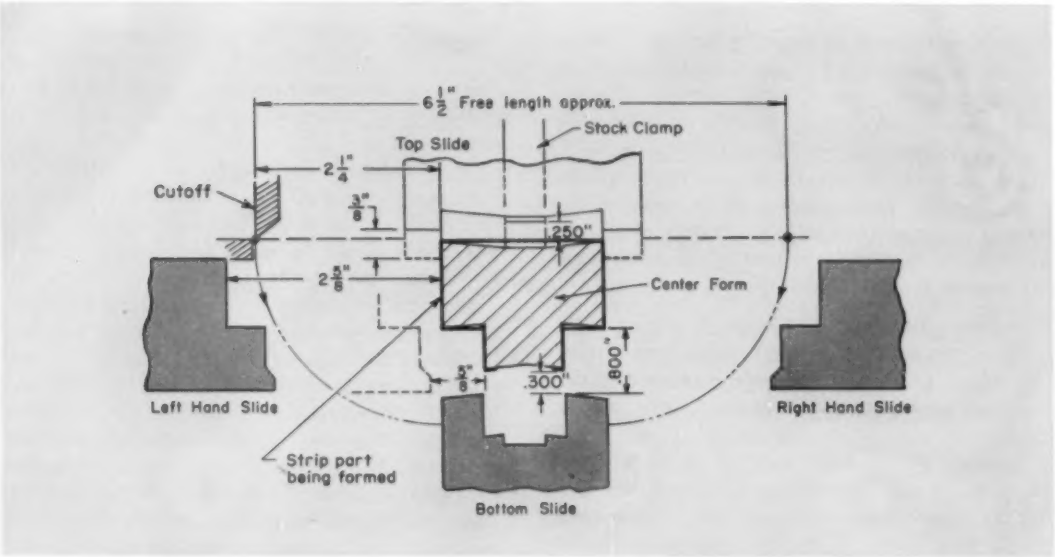


Fig. 3. Layout of work for four-slide forming operation. Making such a layout is the first step in preparing a cam chart. Maximum stroke is determined from information in this drawing.

equal values of h and R_p. The necessity for operating straight-line cams at lower speeds, however, may not be worth the smaller cam rise angles.

Minimizing Total Cam Angle: One of the most difficult problems in actual tooling jobs is to find sufficient time to accomplish each operation within the forming cycle given (usually one full revolution, or 360 degrees). The problem is complicated on almost all automatic machines by the necessity for allowing time to bring in raw or partly finished material and to discharge finished parts. On most forming machines the time to handle the material (feeding and discharging or knockout) amounts to more than half of the total cycle available, leaving perhaps 150 degrees or even less to do the actual work. The available forming time must then be efficiently distributed so as to optimize every motion.

As indicated in Equation 1 and on the tilted graph in NOMOGRAPH 1 there are several ways in which the cam rise angle for a particular motion can be reduced:

1. Make the pressure angle as large as possible (limited to about 30 degrees by the possibility of self-locking).
2. Choose the minimum possible stroke h.
3. Locate the cam track as far away as possible from the cam shaft in order to maximize the cam radius R_p.
4. Select a cam type, such as straight line or simple harmonic, which has a sufficiently small cam factor f at the given constant pressure angle. (This approach has practical speed limitations.)

Assuming that stroke h, maximum cam radius R_p and cam type are fixed by part, machine and speed considerations, the only remaining way to reduce cam rise angle β is to increase the pressure angle. Often a very small increase in the pressure angle for all motions involved can reduce the total required cam rise angle sufficiently to fit a previously unworkable forming sequence into the total available cam angle.

If the tool engineer wants to reduce a cam rise angle based on a pressure angle of 30 degrees, there is usually sufficient safety margin to raise the pressure angle as much as 5 degrees or so. It will be shown in an example, for instance, that an increase of only two degrees in the cam pressure angle can produce a substantial reduction in cam rise angle. As also shown in the example, it may be possible to increase pressure angles even more in individual slide action in which the load is particularly light, such as on return strokes.

Another common way to find more space in a cam cycle is to advance the timing of forming tools in relation to other motions. Of course, this method is particularly effective with tools having long approaches to the work. In any case, no matter how experienced the tool engineer, increases in pressure angle and tool advances both require a good deal of recalculation and cam juggling in order to squeeze a given forming sequence into a practical cam chart.

Step-by-Step Method: The following steps should be followed in preparing a cam chart:

Step 1. Lay out the forming or work area with all pertinent dimensions, indicating the tools in both the closed and fully withdrawn positions, *Fig.* 3. The strip or material might be shown in its path or shape at significant points in the forming cycle.

Step 2. Organize the required charting data with the

help of a table, *Fig.* 4. The table should include for each slide the stroke and pertinent cam dimensions which are determined by the part and the machine. The values of cam rise angle for an initial chart layout and, in case it is necessary, a revised layout must be determined. Assuming $\alpha = 30$ degrees, determine with NOMOGRAPH I, and record the cam rise angle β for each slide. NOMOGRAPH 2 gives (for simple harmonic cams) a convenient method for finding the maximum angle of advance (β_a) for a motion without interfering with the previous motion.

Step 3. Plot an initial cam chart layout, *Fig.* 5 with all motions following each other without delay or advance (as one motion stops, the next starts). If the sum of the resulting cam angles fits within the total available angle, this chart is the solution. Usually, however, the plotted total cam angle at the end of the last stroke is too great, and the chart must be corrected, as shown in *Step 4.*

Step 4. Prepare a revised cam layout, *Fig.* 6, to fit the available cycle time. The steps taken to increase pressure angle or advance various tools are based on study of the forming sequence (*Fig.* 3) and initial layout (*Fig.* 5). This step will be demonstrated in solving the example to be described.

Step 5. Tabulate final cam profile dimensions, *Fig.* 7, as a basis for layout and manufacture of the cam.

These steps are described in detail in the following sections of this article.

Step 1—Forming Sequence: *Fig.* 3 shows a schematic drawing (to scale) of the forming area of a vertical four-slide machine. A clip (heavy line around shaded center form) is being formed from a 6½-inch-long, ⅞-inch-wide piece of steel strip. The strip is fed into the forming area from the left and travels to the right straight across the top of the center form.

After the full length of the strip has been fed into the forming area, the strip is cut at the left and the following sequence of forming steps occurs as the various slides are driven by simple harmonic cams:

1. The stock clamp moves down to secure firmly the strip before and during the forming.
2. The top slide moves down and pushes the two ends of the strip down to a vertical position (the two dot-dash arcs show the paths of the strip ends during this motion).
3. The right-hand and left-hand slides move in to form the side steps. The ends of the strip are bent slightly inward.
4. The bottom slide moves up to complete forming of the strip ends.
5. The knockout pin (not shown) moves forward to push the finished piece off the center form into a chute and then a tote pan. (It should be noted that an alternative method would be to retract the center form, an especially advantageous method on vertical four-slides. This approach results in minimum distortion of parts and more time for forming.)
6. The next section of strip stock advances into the forming area, is cut off and the full cycle is repeated.

Several significant observations can be made about the forming sequence in *Fig.* 3 before proceeding with the table and cam chart:

1. The top slide should not touch the strip until the stock clamp is fully advanced, so that there is no possibility of shifting the strip's position.
2. The side slides cannot move before the top slide is sufficiently advanced, so as to clear the ends of the strip as they sweep down to the vertical position. Although it is possible that the side slides might be somewhat advanced, the saving in rise angle seems negligible and is hard to predict.
3. The side slides must be allowed to return at least ⅛ inch from full advance to provide proper clearance for operation of the bottom slide.
4. It is possible that some advance can be made in the motion of the top slide, bottom slide and knockout pin.

Step 2—Cam Data: The table in *Fig.* 4 lists the slides in order of their motions. Except for the knockout pin, the maximum cam stroke h for each slide is taken from the operating layout in *Fig.* 3. The dimension C is the distance between cam roll and the center line of the cam shaft when the slide is in the extreme forward position (closed). As shown in *Fig.* 7, the dimension R_p is the distance between the cam roll and the centerline at the middle of the stroke ($C - \frac{1}{2}h$).

Each angle of cam rise β can be calculated in Equation 1 for the cam factor and the given cam dimensions. Even with a slide rule, however, this procedure is tedious. NOMOGRAPH 1 simplifies the procedure to merely drawing lines between known values.

The cam rise angle for motion of the side slides

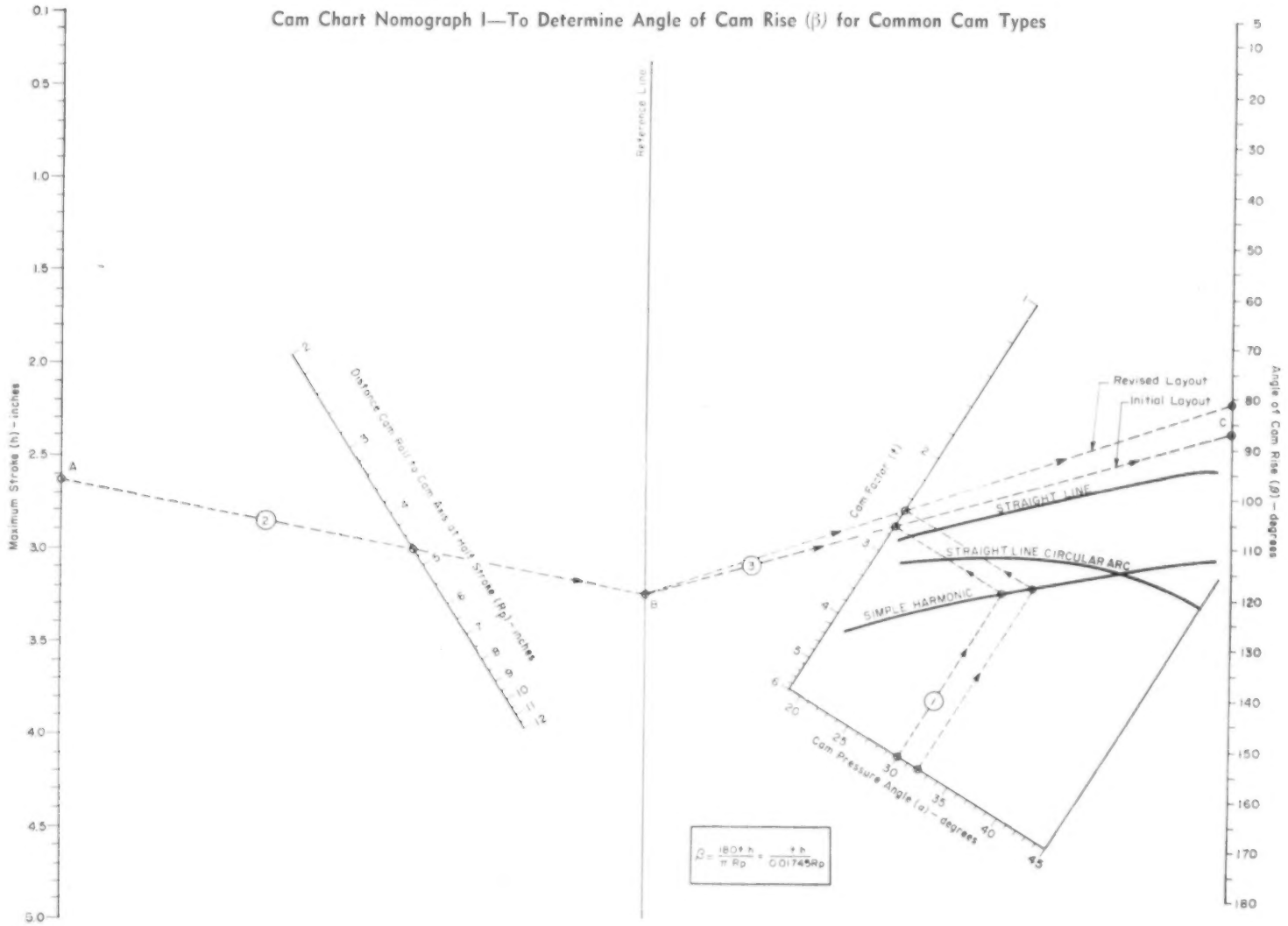
Table for Cam Chart Layout

Vertical Four-Slide Member in Motion	Maximum Cam Stroke H, inch (Taken from Fig. 3)	Maximum Radius, Cam Center to Roll Center C, inch	Distance, Cam Roll to Cam Center at 1/2 Stroke, inch	Angle of Cam Rise β, deg				
				Values from Nomograph 1* (α = 30 deg)	Adjusted Value Used for Convenience*	Values in Nomograph 1 for α = 32 deg*	Adjusted to Fit Total Angle Available	
							Forward	Return
Stock Clamp	0.250	4.000	3.875	10	10	9	10	10
Top Slide	0.375	4.000	3.813	15	16	14	15	15
Side Slides	2.625	6.000	4.688	87	90	81	80	80
Bottom Slide	0.800	4.000	3.600	34	35	32	32	27
Knockout	1.000	4.000	3.500	44	45	41	40	35

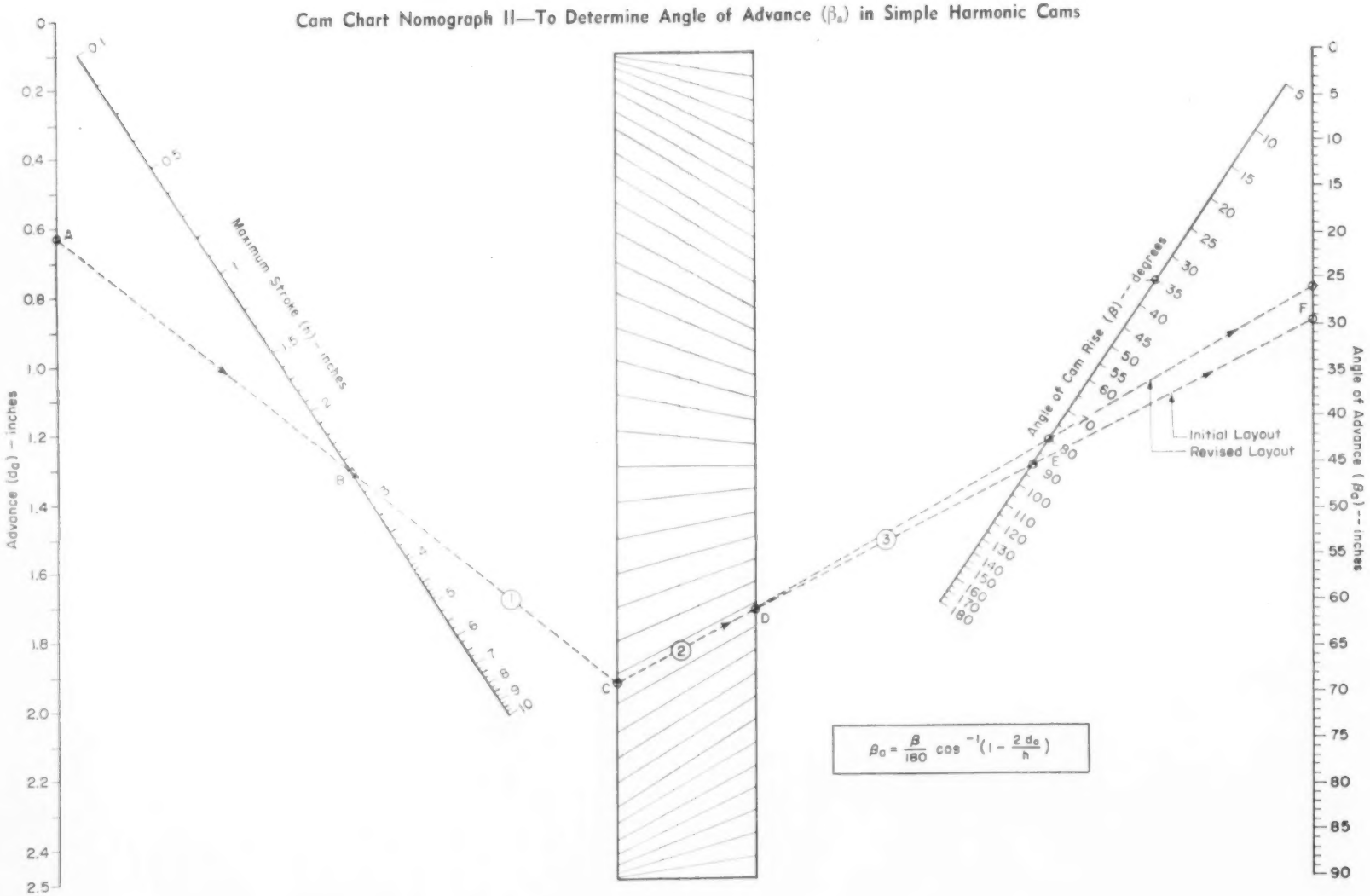
* Both forward and return stroke.

Fig. 4. Table used in preparing cam chart layout.

Cam Chart Nomograph I—To Determine Angle of Cam Rise (β) for Common Cam Types



Cam Chart Nomograph II—To Determine Angle of Advance (β_a) in Simple Harmonic Cams



$$\beta_a = \frac{\beta}{180} \cos^{-1}\left(1 - \frac{2\,d_a}{h}\right)$$

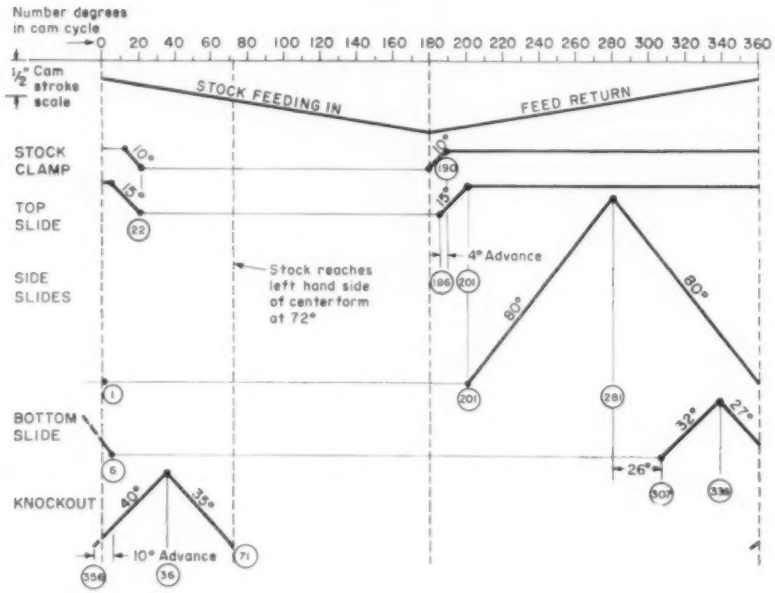


Fig. 5. Initial layout for cam chart. This does not fit cycle time.

is determined in NOMOGRAPH 1 as follows:

1. On the tilted cam-factor graph at right, draw a line up from $\alpha = 30$ degrees on the lower "Cam-Pressure Angle" scale to the heavy simple harmonic cam curve. Then draw a line over from the point of intersection to the "Cam-Factor" scale on the left of the tilted graph. The intersection with the cam-factor scale, in this case $f = 2.7$, is the cam factor for all initial calculations based on $\alpha = 30$ degrees.
2. Draw a line to the right from $h = 2.625$ (*A*) on the far-left "Maximum Stroke" scale through $R_p = 4.688$ (about 4.7) on the slanted scale for "Distance Cam Roll to Cam Axis at Half Stroke" so that it intersects the reference line at *B*.
3. Draw a line from point *B* through $f = 2.7$ on the cam-factor scale (already marked for "Initial Layout") so that it intersects the far-right "Angle of Cam-Rise" scale. The point of intersection *C* (Initial layout) at $\beta = 87$ degrees is the required cam-rise angle for the side slides at $\alpha = 30$ degrees and is so recorded in the center column of the table in *Fig.* 4.

The cam-rise angles for each of the other four slides are determined in NOMOGRAPH 1 in a similar manner. As indicated in *Fig.* 4, these angles are assumed equal in the initial layout for both forward and return strokes. To prepare for using reference tables or blown-up layouts in finding final dimensions of the cam profile, the next column to the right in *Fig.* 4 gives slightly rounded values for the cam-rise angles determined with NOMOGRAPH 1. These adjusted values are the figures used in preparing the initial cam layout:

Since the bottom slide cannot begin its forward stroke until the side slides have returned ⅝-inch from full stroke, it is necessary to determine what cam angle in degrees is equivalent to a ⅝-inch motion of the side slides. The angle of advance (or delay) for a simple harmonic cam is given by

$$\beta_a = \frac{\beta}{180} \cos^{-1}\left(1 - \frac{2d_a}{h}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where d_a = advance (or delay) in inches. For the side slides, $\beta = 90$ degrees, $h = 2.625$ inch, and $d_a = 0.625$ inch. NOMOGRAPH 2 for simple-harmonic cams gives a quicker way to determine the value of the angle of delay β_a directly.

Delay of the bottom slide in *Fig.* 3 is determined as follows:

1. Draw a line from $d_a = 0.625$ on the left-hand "Advance" scale (*A*) through $h = 2.625$ on the slanted "Maximum Stroke" scale (*B*) to intersect the left-hand edge of the lined block in the center at *C*.
2. Draw a line from the left-hand intersection (*C*) to a point *D* on the right-hand edge of the block so that the intersection on the right-hand edge is proportionately in the same position as point *C* between the two adjacent slanted lines. Draw a line from *D* through $\beta = 90$ degrees (*E*) on the slanted "Angle of Cam Rise" scale to intersect the right-hand "Angle of Advance" scale (*F*). The intersection at the right is at about 29.5 degrees, which will be assumed $\beta_a = 30$ degrees in the example. This figure means that the bottom slide can start moving up when the side slides have moved back 30 degrees.

NOMOGRAPH 2 can be used whether β_a is an advance or delay, as long as the value of d_a used refers to the proper point in the slide stroke. As will be shown NOMOGRAPH 2 can also be used backwards to find the advance in inches (d_a) for a given angle of advance (β_a).

It is evident in *Fig.* 3 that all forming motions must be finished before the new stock being fed in interferes. The limiting point beyond which interference will occur is 2¼ inches to the right of the

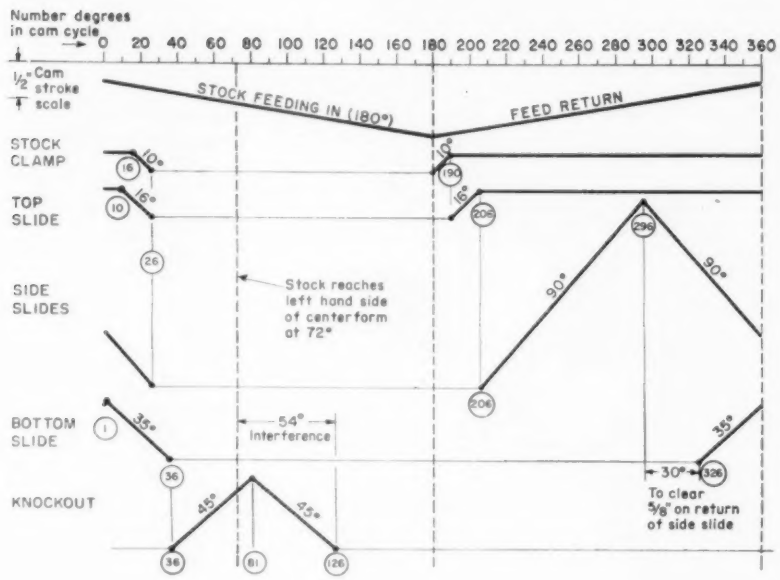


Fig. 6. Revised layout for cam chart to fit available cycle time.

cut-off (at the left-hand edge of the center form). Assuming that the stock feed cam is also a simple-harmonic type, NOMOGRAPH 2 is used with $d_a = 2.25$ inches, $h = 6.50$ inches, $\beta = 180$ degrees and it is found that $\beta_a = 72$ degrees at the limiting point. The next step is initial cam layout.

Step 3—Initial Cam Layout: The initial cam chart layout in *Fig.* 5 is made on a sheet scaled horizontally for the 360 degrees in a full cam cycle. All the cam cycle angles in this chart have been obtained from adjusted values in *Fig.* 4. Although not entirely necessary, a uniform vertical cam-stroke scale has also been used in order to show the relative magnitude of the full strokes for all the slides. The 180-degree cycles for stock feeding in and feed return are indicated at the top. Beginning with forward motion of the stock clamp at 180 degrees, after the stock feed has been completed, the motion of each slide is drawn in sequence on separate lines on the cam-cycle scale.

The stock clamp advances 10 degrees (from 180 degrees to 190 degrees) in the cam cycle. A point is located 0.250 inch (to scale) up from the base at 190 degrees, corresponding to the maximum cam stroke $h = 0.250$ inch into the forming area. Motion of the top slide begins at 190 degrees, at the point where the stock clamp is fully advanced and the stock-clamp cam begins to dwell. The top slide requires a cam-rise angle of 16 degrees to 206 degrees for its maximum stroke of 0.375 inch, at which time the top-slide cam dwells. Both side slides begin simultaneously to advance through a 90-degree cam-rise angle when the top slide has reached full stroke and begin to withdraw immediately at 296 degrees after completing their forming function. The side slides are not fully withdrawn, however, until the cam cycle has reached 26 degrees into the next feed cycle. The return strokes of the stock clamp and top slide are timed to begin just after the last forming motion has been completed. In this example, forming ends as the bottom slide begins to return at a cam angle of one degree.

As found in *Step* 2, the bottom slide cannot begin to move up until the cam cycle is at 326 degrees, 30 degrees after the side slides have begun to withdraw. The knockout, which in the initial layout is assumed to begin to move forward when the bottom slide is fully withdrawn at 36 degrees in the next cycle, requires a total angle of 90 degrees to eject the formed part and withdraw completely without any dwell. Unfortunately, the knockout finishes at 126 degrees instead of at 72 degrees, where the stock reaches the center form. Because there is liable to be interference between the knockout pin and the stock feeding in before forming has been completed, 54 degrees must be eliminated in *Step* 4.

Step 4—Revised Layout: In planning the revised cam chart in *Fig.* 6, 55 degrees have been cut from the forming cycle in three ways: (1) the pressure angle has been increased to 32 degrees for all cams; (2) the return strokes of the bottom slide and knockout have each been reduced, and (3) the top slide and knockout have both been advanced.

The new values for cam-rise angles with $\alpha = 32$ degrees in the revised chart were determined in NOMOGRAPH 1 and recorded in *Fig.* 4. The cam-rise angle for the side slides, for example, has been reduced from 87 degrees to 81 degrees (dotted ex-

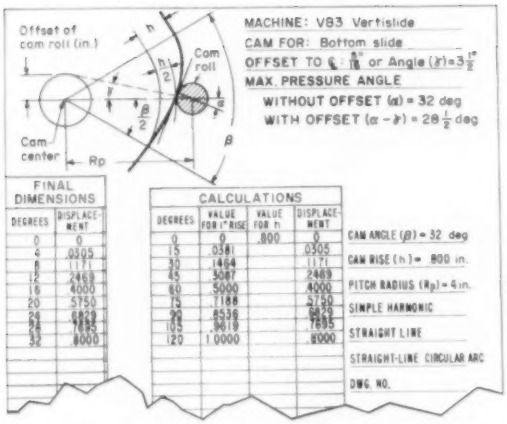


Fig. 7. Cam chart for four-slide forming operation shown in *Fig.* 3. This is used by cam designer.

ample in NOMOGRAPH 1). Changing in several cases to more convenient figures for calculation, a total of 19 degrees has been saved on the forward strokes alone. In addition, the decrease in the return angle of the side slides from 90 degrees to 80 degrees reduces the delay necessary to clear the side slides from 30 degrees to 26 degrees, as determined in NOMOGRAPH 2.

The return strokes on the bottom slide and knockout have both been made 5 degrees smaller than the revised forward stroke angles. Even though the pressure angle for these strokes is then slightly higher, there is little danger of self-locking because of the lower forces on the return stroke. The total reduction in cam angle in the return stroke is then 18 degrees.

It is evident in *Fig.* 3 that it should be possible to start the forward stroke of the top slide somewhat before the stock clamp has reached full stroke. Although the actual distance is small since the total stroke of the top slide is only 0.375 inch, the saving in rise angle may still be worth considering. If the advance (d_a) is assumed to be 1/16 inch, the side lobes of the top slide will just barely reach the top of the strip at the instant the stock clamp presses the strip against the center form at its full stroke.

NOMOGRAPH 2 is used to find β_a for $d_a = 0.0625$ inch, $h = 0.375$ inch, and $\beta = 15$ degrees. The resulting angle of advance of the top slide is $\beta_a = 40$ degrees.

With a space of 0.300 inch between the bottom of the center form and the bottom tool, there is clearly an opportunity for advancing the knockout pin before the bottom slide has finished its return stroke. The only requirement is that the bottom tool not hold the part against the center form as the knockout pin is pushing the top of the part forward.

Rather than pick a maximum advance (d_a) in inches for the bottom slide, it would be more logical to determine first how much additional reduction in total cam angle is necessary to complete the cycle before reaching 72 degrees in the feeding cycle. Increase in the pressure angle, reduction of the return angles for the bottom slide and knockout, and advance of the top slide have so far reduced the total cam rise angle 45 degrees. Therefore, at least 9 degrees more must be cut from the total rise angle. Assuming then that the knockout is advanced 10 degrees, NOMOGRAPH 2 is used backwards to find the equivalent advance (d_a) for $\beta_a = 10$ degrees, $\beta = 27$ degrees and $h = 0.800$ inch.

NOMOGRAPH 2 is used backwards by drawing a line from $\beta_a = 10$ degrees on the right-hand scale through $\beta = 27$ degrees on the next slanted scale to intersect the right-hand edge of the center block. A line is then drawn over the left-hand edge to a point in the same relative position between the two adjacent solid lines. A line is drawn back from the left-hand edge through $h = 0.800$ on the slanted "Maximum Stroke" scale to intersect the left-hand "Advance" scale. The advance determined in this matter is $d_a = 0.24$ inch. An advance angle of 10 degrees for the knockout is therefore acceptable, since the bottom slide will be moving out $0.30 - 0.24 = 0.06$ inch below the center form when the knockout starts forward.

The revised cam chart in *Fig.* 6, including all the changes discussed, therefore fits (just barely) all the requirements of the feed cycle by completing the forming sequence for the part in *Fig.* 3 at 71 degrees. It is certainly possible after all opportunities for reducing the total cam angle have been taken that there will still be an insufficient angle available for forming. In such cases, it is then necessary to revise the forming sequence or, if provided on the forming machine, reduce the stock-feed angle to less than 180 degrees.

Step 5—Profile Calculation Table: After completing the cam chart, the tool engineer can calculate and record actual dimensions of the cam profile for cutting, as has been done in *Fig.* 7 for the bottom slide. The time required to make these calculations can be reduced considerably with the help of cam profile tables published by a number of sources. A more convenient method in many cases may be to lay out a greatly expanded drawing of the cam profile.

The cam-chart method presented here may be adapted in designing practically any cam system. The accuracy of the two nomographs is sufficient for most applications, for which the cam rises are rounded to the next convenient angle as a matter of course. One or two degrees between motions should be allowed wherever possible. After becoming accustomed to this approach and the use of the nomographs, it should not require more than two or three hours to plan an entire cam system.

ASME news

Dr. Allen V. Astin

Whitney Lecturer

When Eli Whitney proposed in 1798 "to make the same parts of different guns, as the locks, for example, as much like each other as the successive impressions of a copper-plate engraving," he was talking about standardization.

When Dr. Allen V. Astin delivers the fourth annual Eli Whitney Memorial lecture on April 25, he will also be talking about standardization. The subject is fitting for the occasion—for standardization makes stable the interchangeability of parts concept that is the basis of Whitney's greatness. And the subject fits the man—for Dr. Astin is director of the National Bureau of Standards and one of the free world's foremost exponents of the need for accurate measurements.

Dr. Astin's subject will be "The Basic Standards

70 Technical Papers

RUNNING THROUGH the eight days of ASTME's Engineering Conference and Exhibit in Detroit this April 21-28 is the backbone of the whole show—the technical sessions.

More than 70 technical papers, arranged into 35 assorted seminars, panels, symposia, "Techtours" and straight sessions, will be presented for the thousands of Society members and guests.

Perhaps much of the public interest will be elsewhere—such as at the $15-million Tool Show, where some 900 new ways to increase productivity will be on exhibit for the first time; or at the Industrial Progress Dinner on April 22, when President Rudolph F. Bannow of the National Association of Manufacturers will speak; or the Michigan Day kickoff luncheon on April 21, with Dr. Abe Silverstein, space flight development director of the National Aeronautics and Space Administration, as principal speaker; or the Business Outlook luncheon on April 26, at which a panel of economics experts will be interviewed by the metropolitan press. . . .

But the combination of forward-looking subjects and a forward-looking audience assures that the technical sessions will perform their mission of telling tool and manufacturing engineers what is going on in their profession.

In addition, some of the sessions—such as a three-paper examination of medical and surgical engineering—should prove worthy headline-making competition for the more spectacular attractions of the convention.

Session on Humane Engineering

The "engineer in medicine" continues a study in which the ASTME has pioneered. A series of medical-tool engineering forums in the Detroit and Ann Arbor areas last year resulted in the application of engineering brains to devising and improving medical equipment, especially in the field of heart surgery. One apparatus, a blood bubble-trap built by a tool engineer in his Ann Arbor basement, has passed clinical tests and has been hailed by the medi-

is Standards Chief

of Physical Measurement." His lunch-time audience at Detroit's Statler-Hilton Hotel will be ASTME members and guests assembled for the week-long Engineering Conference and Exhibit.

The National Honor Awards Committee, in its choice of Dr. Astin for the Society's award in memory of the father of mass production, was influenced by these highlights of a full career:

—In research on the NBS staff from 1932 to 1940, Astin discovered and developed improved methods of measuring dielectric constants and power factors of dielectric materials.

—Pioneer work in the development of radio telemetering techniques and instruments, which were applied by Astin himself to studies of meteorological problems and cosmic rays. His techniques have been widely used by scientists in studies involving the upper atmosphere.

—Leading role in the development of proximity fuses during World War II.

—As associate director of NBS 1950-52, he was responsible for the bureau's basic instrumentation, ordnance development, missile, electricity and electronics divisions.

—Appointed director of NBS by the President and confirmed by the Senate in 1952, he has since supervised the bureau during the nation's critical ascent into the space age.

A native of Salt Lake City and graduate of the University of Utah and of New York University, Dr. Astin holds honors and awards from both his own country and Britain.

. . . Backbone of Conference

cal profession as a "superb" contribution. The cooperative movement, marking the first time an engineering society has volunteered its know-how in the interests of medical science, has steadily gained momentum until it has found a formal place on the Society's 28th Annual Meeting program.

A professor of surgery at Harvard Medical School, Dr. Carl W. Walter, will present the first paper (No. 299) on "The Engineer in Medicine." Willis C. Gorthy, director of the Institute for the Crippled and Disabled, will offer another challenge in the field—"Rehabilitation Needs the Engineers" (Paper No. 300). Editor John W. Greve of THE TOOL ENGINEER, which first gave national publicity to the engineering needs of medical men in an article last May, will deliver a paper (No. 301) on "Tooling for the Handicapped." He will attempt to outline areas in which tool engineers may serve humanity and will report on what industry has already contributed to the individual and social well-being of this less fortunate segment of workers.

ASME Exchange Papers Scheduled

Continuing a fruitful exchange of information with other scientific and technical societies, ASTME members will have the opportunity of hearing two outstanding papers (Nos. 278 and 251) by members of the American Society of Mechanical Engineers. "Engineering Application of Digital Computers" will be read by H. D. Irwin, mechanical equipment consultant for E. I. du Pont. Paul Albrecht, research associate for The Cincinnati Milling Machine Co., will describe "New Developments in the Theory of the Metalcutting Process."

'Techtours'—New Programming Technique

An innovation in technical session programming, as announced by Program Director Leslie S. Fletcher, will be the "Techtour" on gun drilling scheduled for Friday, April 22. Under the new format, papers will be presented during the morning, followed by a special plant tour in the afternoon

that ties in with the subject. A climactic evening session will feature a panel discussion of the same subject, growing out of the papers and the plant tour. Authors of the papers and representatives of the plant will make up the panel.

The gun drilling sessions will consist of four papers in a session chairmanned by George R. Squibb, president of the Automotive Conversion Corp.; a tour of the Star Cutter Co. plant (see accompanying picture) near suburban Farmington, Mich.; and the evening panel again chairmanned by Squibb.

Special Seminar on Metrology

One of the Society's 1959-60 series of Creative Manufacturing Seminars will be presented as a package attraction during the Detroit Engineering Conference. The two-day, ten-paper seminar on dimensional metrology will be offered to members for $50, to nonmembers for $75.

Starting Tuesday morning, April 21, with an introductory paper (No. 239) on "Can You Measure It?" by Dr. Lewis V. Judson, National Bureau of Standards physicist, the seminar will cover the new international inch, recent advances in measurement accuracy, the ever-increasing tightness of tolerances, and other measurement challenges that have arisen in almost direct proportion to man's ascension into space. The windup paper (No. 248) will look at "What's New on the Gaging Horizon?" The author is Louis F. Polk, Jr. assistant vice president and manager of the Instruments and Systems Div., Sheffield Corp.

Engineering Education Day

Saturday, April 23, has been designated Education Day during the convention. At a morning session chairmanned by Clyde L. Fanning of the General Motors Institute, Flint, trends in engineering college enrollment will be discussed by Engineering Dean William Thurlow Alexander of Northeastern University and Executive Secretary Leroy K. Wheelock of the Engineering Manpower Commission, Engineers Joint Council.

Detroit Conference "Techtour"—integrated papers and plant tour on gun drilling—will take registrants to the Star Cutter Co., a 50,000-square-foot plant near suburban Farmington. Here is a portion of the back-off department at Star Cutter, where milling cutters, end mills and Accurate Unground-Form hobs are processed. The tour is scheduled for Apr. 22.

Chairman Arthur F. Gould of the Society's National Education Committee, who is head of the Industrial Engineering Department at Lehigh University, will chairman the afternoon session. A talk on "Engineering Education for the Future" by Dean William L. Everitt of the University of Illinois College of Engineering will be followed by a paper (No. 293) entitled "Tool Engineering—Our Place in Education," by Prof. Frederick Preator, tool engineering department head at Utah State University.

Symposium on Automation

Particularly rich in promise for tool and manufacturing engineers who are looking for depth treatment of automation and numerical control will be a special three-part symposium on Tuesday, April 26.

Another innovation in programming will be tested under fire at the symposium. All participants must preregister; the $3 fee includes all symposium papers and badge which will also admit the holder to the other technical sessions and exhibits. *No papers will be presented* during the symposium, but will have been mailed to registrants for study in advance of the symposium. Authors will be on hand to give supplementary material necessary to update the papers, and to answer questions. Discussions will occupy the full time of the symposium sessions.

The managing editor of *Automation* magazine, James C. Keebler, who is also a member of the Society, will set the stage with his introductory paper (No. 279). Other paper titles that promise to intensify interest in an already hot subject are: "A Hole in the Tape Is Worth Two in the Head," "Areas in Which Automation Is Useful," "Field Experiences with Automation."

The evening session, marked "Symposium III" on the program, will consist entirely of individual conferences with all the preceding speakers.

Other sessions will cover standardization and machine design; improvements sparked by research; value analysis; communications (including "The Impossibility of Communication" by Patrick M. Beatts of IBM Corp.); radiation and the tool engineer; sonic energy as a production tool; high-energy (explosive) forming; production programming; numerical control versus tracer control of machine tools; the plasma-arc process; and machining and welding with electron beams.

All technical sessions will be held at Detroit's Sheraton-Cadillac Hotel. All papers will be published and will be available from ASTME Headquarters.

Cecil E. Chapman

Frank D. Clark

Albert Underwood, Jr.

Petitions Add 3 to Director Slate

Three men have been added to the slate of candidates for the National Board of Directors, through petition of 20 or more members of the ASTME. This brings the list of nominees for the board to 21.

The House of Delegates will elect 14 directors at their next Annual Meeting, to be held in Detroit April 25. The retiring president, Wayne Ewing, automatically becomes the 15th director.

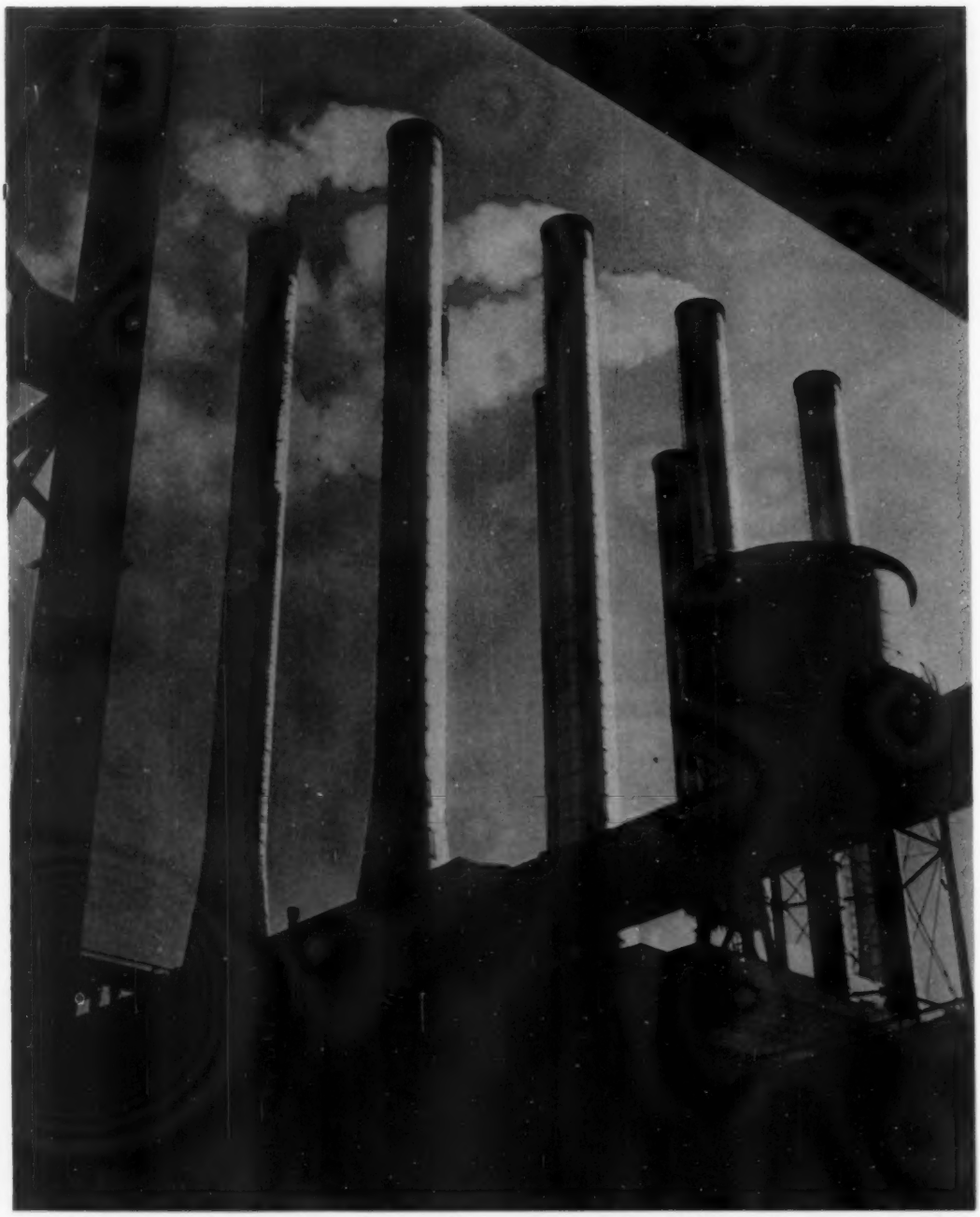
The 18 candidates selected by the Annual Nominating Committee were sketched in the January issue of THE TOOL ENGINEER. Those nominated by petition include:

Cecil E. Chapman, superintendent of the Rail Accessories Dept., Inland Steel Co., East Chicago, Ind., served the ASTME as a director in 1958-59. He was a member of the steering committee to obtain a charter for the Calumet Area chapter, of which he is past chairman. He is also past chairman of the Indiana Council of Chapters. Chapman is field editor for THE TOOL ENGINEER and has authored a number of technical papers. He is now serving on the National Long-Range Planning Committee. An alumnus of the University of Wisconsin, he has a background in metallurgy, tooling, machinability research and supervision of manufacturing practices. He belongs to the National Management Association and Chicago Chamber of Commerce.

Frank D. Clark chairmanned Boston chapter in 1957-58 and has held all chapter offices except secretary. He has also served at the chapter level as chairman of standards, nominating and Constitution and Bylaws committees. He is currently a member of the National Program Committee. During 23 years with the Van Keuren Co., Clark has advanced from apprentice to assistant production manager and is now vice president, secretary and director of the company. He is a member of other technical and civic groups and has given technical talks on "Measuring in Millionths" to approximately 25 chapters of ASTME from the East Coast to Denver.

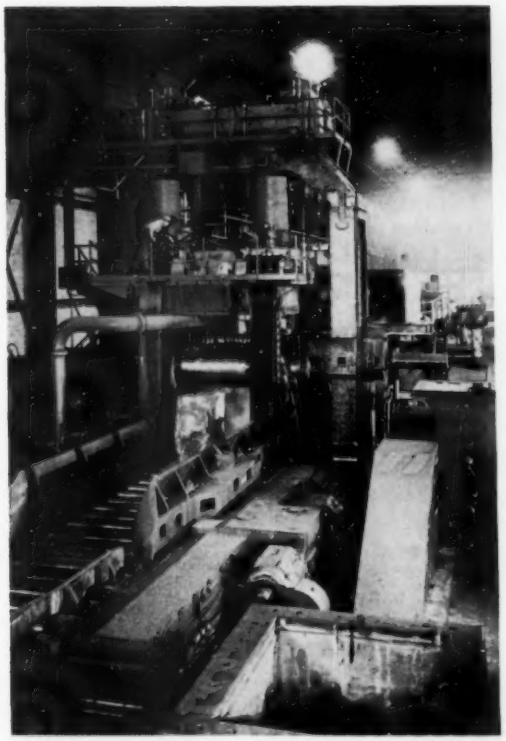
Albert Underwood, Jr., present chairman of Windsor chapter, has also served that group as editorial chairman, program chairman, treasurer and vice chairman. He joined the Society in 1948. A graduate of the University of Detroit business management course, Underwood has held various positions of increased responsibility with the Ford Motor Co. of Canada, Ltd., starting as a graduate of their trade school. He has been a process engineer, machinery process supervisor, superintendent of production engineering department, assistant general superintendent of production engineering department, assistant general superintendent of manufacturing engineering, divisional quality control manager and is currently acting manufacturing manager of Ford's Windsor manufacturing operations. Long active in Canadian ASTME work, Underwood was program chairman for an on-campus conference at McMaster University last fall.

Industrial

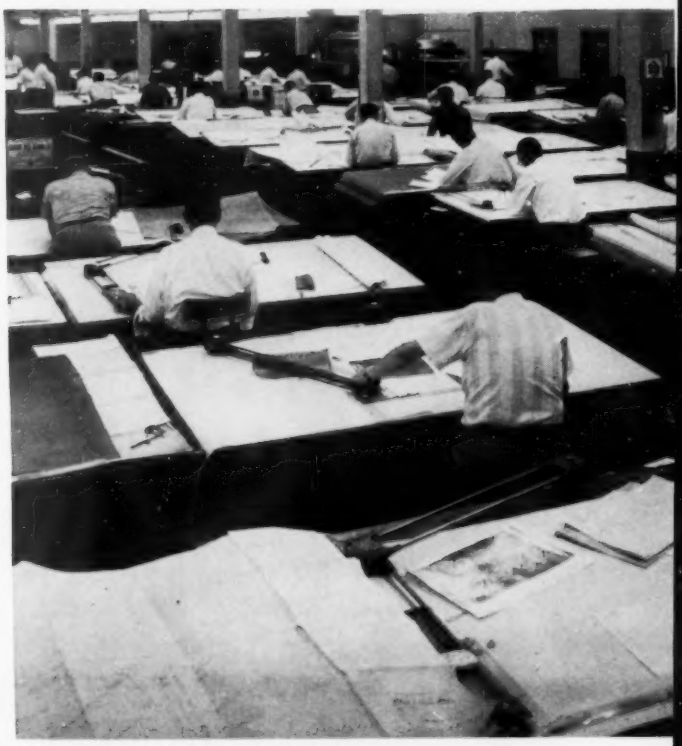


Exemplifying metropolitan Detroit, one of the world's great industrial complexes, are the powerhouse smoke-stacks at the huge Rouge plant of the Ford Motor Co. The 1200-acre colossus in Dearborn contains buildings with 15,500,000 square feet of floor space, employs 63,000, has 110 miles of railroad line. All operations from raw ore to 1960 model automobile are at the Rouge, and many of them will be on exhibit for ASTME convention and tool show visitors during tours scheduled for April 22 and 26.

Muscle on Exhibit

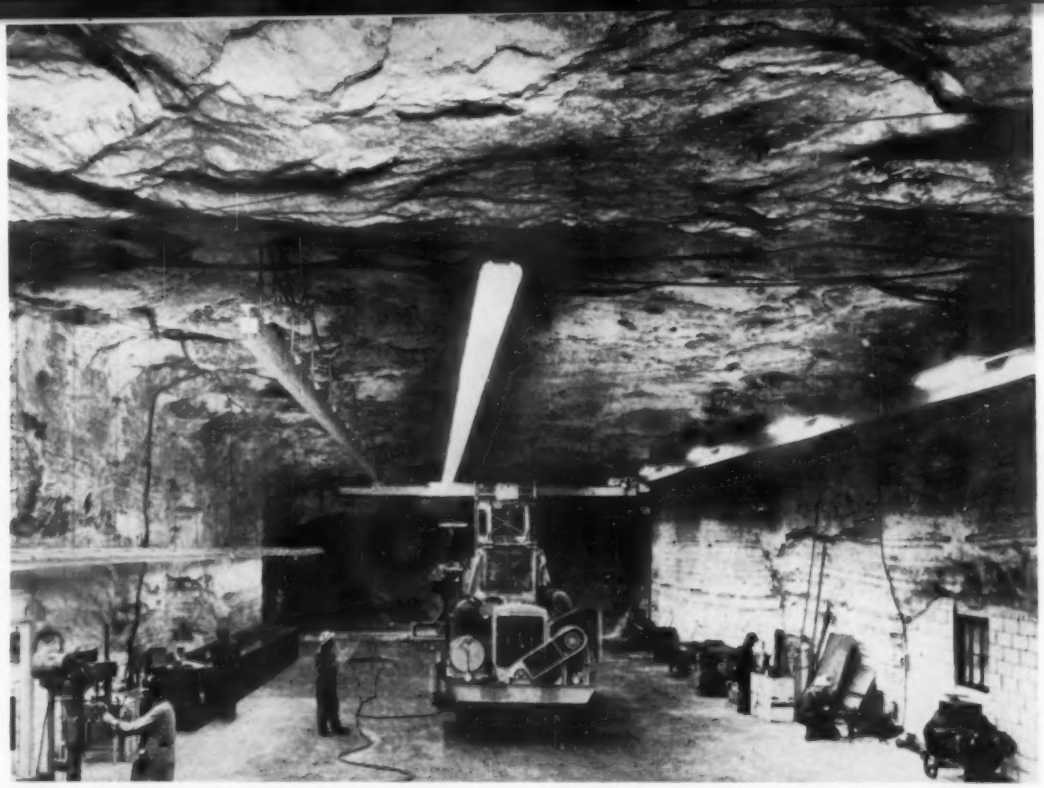


Ingot enters the No. 3 slabbing mill at Great Lakes Steel Corp. plant in down-river Detroit area. ASTME visitors will see 50,000-pound ingots reduced to six-inch slabs, which in turn will be hot-rolled to a 90-inch-wide sheet. Mill has a capacity of 3,200,000 tons of steel per year. The tour is scheduled for April 28.



Exemplifying the brains behind the city's industrial muscle is this scene of the machinery engineering department of Ex-Cell-O Corp., Detroit, makers of tape-control machines, broaches, cutting tools, and other precision machines. The plant will play host to the ASTME convention visitors on Friday, April 22.

Automatic lens grinding and polishing equipment enables Argus Camera plant at nearby Ann Arbor to reach production of 18,000 lenses per day. ASTME tour will also include the camera assembly line.



Ojibway Salt Mines, 1080 feet underground near Windsor, occupies a 32-acre "city" of solid rock salt where the temperature is 60 F the year round. The ASTME tour is scheduled April 25.

Assembly Line of the Past

Line-up of 175 antique cars in the Henry Ford Museum shows the three phases of automotive development—steamers, electrics and gasoline-powered autos. Arranged chronologically, the cars start with an 1863 Roper Steam Carriage. ASTME men and their wives will be among the million tourists yearly who view the Museum and adjacent Greenfield Village in Dearborn. A special presentation on the history of mass production, "Panorama Americana," has been arranged for the ASTME tour on Sunday, April 24. The $3.75 ticket includes transportation and admission charges to both the Museum and Village.

host committee sets the stage

WHEN 35,000 METALWORKING people descend on Detroit this April, many of their activities will have been planned by fourteen men and one woman.

Swinging into action early last year, these planners—the Detroit Host Committee—of the 1960 ASTME Engineering Conference and Exhibit began immediately recruiting name speakers for the main feasts, helping round up authors of important technical papers for the sessions, scheduling industrial and cultural sights for tours, and reserving facilities for the conventioneers' stay in the Motor City.

The 1960 meeting and Tool Show is taking place in the city that nurtured mass production and spawned the American Society of Tool and Manufacturing Engineers. These factors were like so many volts of civic pride turned on within a host committee that, with a past national president as its head, really didn't need much to get it generating.

Leslie Bellamy, who as chairman might be called the producer or impresario of the Detroit drama, is an old hand at staging and promoting ASTME productions. He was the president of the Society during the 1952-53 term. He has lined up a crack crew of production assistants to put the show on its feet. All have a thorough knowledge of the script—"Tooling for Productivity." Some are with the Detroit chapter, others are from outlying ASTME groups. There are 11 area chapters in all working on plans for the April event. They are: Detroit, Toledo, Grand Rapids, Windsor, Saginaw Valley, Oakland County, Ann Arbor Area, Jackson, Lansing, Muskegon and Macomb.

The program for the 1960 ASTME Engineering Conference and Exhibit will contain the following list of credits under the title Detroit Host Committee: Leslie Bellamy, general chairman; Bernard Wallis and Joseph Wrobel, vice chairmen; Carl Abbott, National Program Committee zonal member and technical sessions chairman; Stanley Phillips, secretary; Wayne Kay, Div. A and plant tours chairman; Mrs. Joseph Wrobel, ladies' activities chairman; Monta Cox, transportation chairman; Owen Harvey, Div. B chairman; Clyde Mooney, Div. C chairman; Clyde Hause, emergency chairman; Leon Butler, tickets chairman; Andrew Carnegie, Div. D chairman; Edward Till, publicity chairman; and William McClellan, reception.

But there is another Detroit Host Committee in existence—an honorary one. Five of the nation's industrial leaders have been chosen to serve on the committee. At a Michigan Day luncheon special tribute will be paid to L. L. Colbert, president of Chrysler Corp.; Malcolm P. Ferguson, president of Bendix Aviation Corp.; Henry Ford II, president of Ford Motor Co.; John F. Gordon, president of General Motors Corp.; and George Romney, president of American Motors. The five were selected because they best represent the spirit of Detroit.

Emergencies arising during the Detroit meeting will be handled by Clyde Hause, who is chairman of that committee.

Outlining one of his promotion campaigns to Andy Carnegie, his boss on the Detroit Host Committee, is Ed Till (right), chairman of publicity for the ASTME Engineering Conference and Exhibit.

Chips and Chatter

Members of NASHVILLE chapter ate up a recent program. Five of the eight tool and die shops in the area were hosts to a round-robin plant tour. At the first shop the 125 members and guests had appetizers; at another, salad; at the next one, the main course; at the next, dessert; and after-dinner beverages at the last one. The job shops—Wamser, Stewart and Vaughn; Capitol Tool and Die; Fred D. Wright Co.; Bennett Tool and Die; and J. E. Weatherford and Son Co.—gave tool and manufacturing engineers a good idea of the increasing scope of their work in Nashville, according to Editorial Chairman Harry O. Collins of Chapter 43. The five tool and die shops employ 197 people.

When James J. Rost (below, right) took a job at the AiResearch Mfg. Co. of Arizona, in PHOENIX, he was unable to take office as chairman of his old ASTME chapter in GRAND RAPIDS. The Michigan chapter expressed its appreciation for Jim's work by proxy, however; immediate Past Chairman James R. Wagner, Jr., picked Rost for the chapter's annual Service Award, and mailed it off to Phoenix for presentation. Phoenix Chairman John Hamay (left) was glad to oblige—he used Grand Rapids' pin to pin Rost down for duty in Chapter 67.

QUOTE OF THE MONTH: "Our present tax laws are calling to me every day, 'Don't try to build a business; don't try to create something new.' If I listened to the tax laws, I'd be a trader. I'd buy and sell businesses, adding nothing to the real wealth of the country. America needs a new tax law that encourages work, not idleness; that distinguishes creative investment from speculative trading."—Lynn A. Williams, president of Anocut Engineering Co., CHICAGO chapter member.

QUESTION OF THE MONTH: "Don't you ever make a mistake?"—Small daughter of a SAN FERNANDO VALLEY chapter member during question-and-answer session after special technical meeting on tooling for molded plastic toys. Editorial Chairman John R. Bethune reported that speaker Fred Hayner, chief tool designer of Mattel Corp., gave an honest answer . . . "Yes." He described one of the errors in the complex die work that keeps toy production from being child's play.

Etched on the metal plaque pictured below—and etched as well in the memory of Executive Secretary Harry E. Conrad—is a memorable program that kicked off the Society's last Tool Show in Detroit. The bronzed programs were given to the head table at the 1941 affair—and in 1960, with the show's return to Detroit, the tradition will be revived. Here Conrad explains to an editor of THE TOOL ENGINEER that similar "lasting memories" will be distributed to the head table during the 1960 tribute to the Honorary Host Committee (see article on preceding page). The company that made the plaques then is making them now, too—Anderson & Sons, Westfield, Mass., a Tool Show exhibitor.

Washington stages 'Duel' Programs on Automation

By M. L. Stone
News Editor

Chester S. Johns of the Buhr Machine Tool Co. addresses Washington chapter on "Automation and the U. S. Economy." The January meeting drew 60.

BOTH SIDES of the automation controversy got a hearing in Washington recently when ASTME Chapter 48 scheduled consecutive monthly lectures by management and labor.

In addition to evidencing the alertness of tool and manufacturing engineers to one of the great and current issues in America, the meetings also demonstrated that the two sides are perhaps not so far asunder after all.

The unusual pairing of programs featured Chester S. Johns, sales manager of the Buhr Machine Tool Co., Ann Arbor, Mich., at the January meeting, and Ted F. Silvey of the National AFL-CIO research department, Washington, on Feb. 2.

Johns said in substance: Automation is coming of age. Its application is not necessarily universal, and its effect is not necessarily disrupting. Its objective is not negative but positive—not to dislocate labor, but simply to produce more, more efficiently. The problem that America faces is in the *discretionary* application of this wonderful tool for advancing our standard of living.

Silvey's viewpoint: Generally speaking, trade unions look upon the new technology as something desirable, as long as they have a voice—in cooperation with other groups in society—in leading automation in the direction it should go for the good of *all* society.

Arranged by Program Chairman Alfred J. Weisbecker, a Bureau of Ships official, the programs were characteristic of the chapter's 1959-60 agenda, in which topics of high general interest have been interspersed liberally among strictly technical subjects. Along with the automation duo, subjects such as foreign machine tools, the biomechanics of human anatomy, and a panel on the professional status and future of tool engineers represent Washington chapter's effort to recognize two things:

1. Its environment—situated in the national capital, amid the country's decision-makers;

With Chapter Program Chairman A. J. Weisbecker (left) at the January automation session is Ted F. Silvey of the AFL-CIO headquarters in Washington, who was to return in February to tell Washington members about the "Human Factors in Automation."

2. Its membership—some of them drawn from the upper echelons of governmental decision-making bodies, and all of them exposed daily and closely to problems that concern them equally as tool engineers and as American citizens.

Automation Myth Being Dispelled

The AFL-CIO spokesman was among the audience of 60 members and guests when the automatic machinery builder addressed the January meeting. Johns declared that the popular conception of push-button factories with machines that "stretch right over the horizon" is a myth which is rapidly being dispelled before the hard facts of production feasibility. A machine cannot necessarily do a given job more economically than human hands, he said.

"It is often simply more logical to mate two parts by hand rather than by machine," Johns added. "Don't misunderstand me, we could build a machine to do the job. We and others in our field have designs in our plants that are fabulous . . . We could build a machine that could pluck a man's eyes out and put them in his pocket. But that wouldn't be economically—or morally—feasible."

Johns defined automation as "consecutive actions of a repetitive nature, performed on some product." Depending on application, the technology is either extremely successful or it is not: he cited one plant that overautomated and went in the red, and still another ultra-automated facility that saw its profits soar—and its employment rise 800.

In an interview, Silvey echoed opinions expressed in an article which he wrote three years ago for THE TOOL ENGINEER: "Machines with energy are an extension of man and animal muscles. Instruments—quite more recent in their flowering—are an extension of man's five perceptive senses. One way of describing automation is to say it is a marriage of machines and instruments. . . .

The requirements of the new technology on all of us will be considerable. Resistance to the requirements of the scientific, technological and human aspects (of automation) will be common. Trade unions may serve as an outside consultant to top management when top management resists the economic and sociological consequences of the application of the new technology."

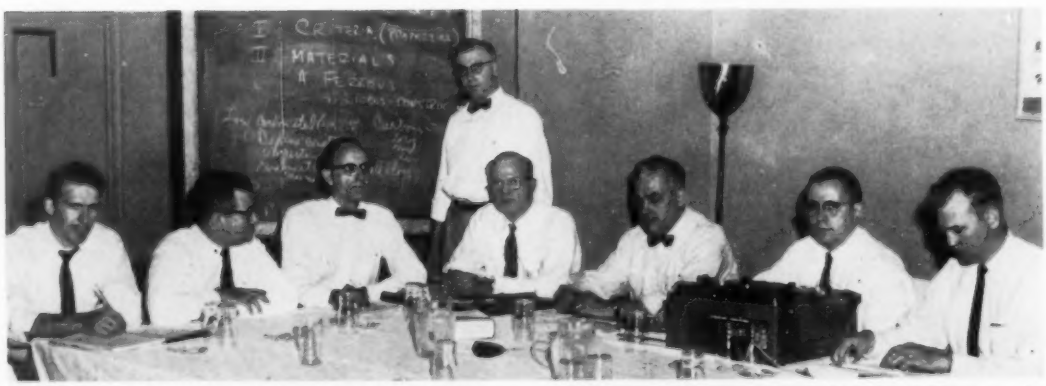
Need Seen for Engineer-Managers

One requirement of automation, Silvey believes, is the more definite integration of engineers into management. The engineer historically has dealt with exact specifications; management has dealt with complexities and relativities, and has often followed "hunches." Automation necessitates a merger of these traditional skills into an engineer-management skill that will recognize man as not just another factor in the productive chain, but the reason for its existence, Silvey asserts.

Both Johns and Silvey agreed that a unified effort is needed on the part of labor and management, as well as the automatic machine builders and perhaps government, to meet the challenges of automation.

Chapter 48, which changed its name from Potomac to Washington a year or so ago, is chairmanned by William E. Summerbell. Its membership is about 175.

Shirtsleeve Meeting on Textbook



Members of the National Technical Publications Committee's textbook subcommittee took off their coats recently at Clemson College, S. C., and worked up an outline and subject matter for an ASTME-sponsored text on tool design. Left to right are Seth J. Beck, Burlington, N. C.; National Director Frank F. Ford of Atlanta; Professor Everett Laitala of Clemson, the host, and Anthony R. Koneeny (standing) of Washington Univ.; NTPC Chairman Willis J. Potthoff, St. Louis; Walter F. Coles, Pittsburgh; Robert E. Nauth, Detroit; Norman G. Foster, Greensboro, N. C. Ford addressed Clemson industrial engineering students.

Accepting certificate and $100 check for winning first prize in the Gadgets Contest is Edward D. Bennett (left) of Northern New Jersey Chapter 14. John C. Hatter (right) of the National Editorial Committee drove to Union, N.J., from Long Island to deliver the good news. A friendly onlooker is Past Chairman Carl Slonkosky.

Prize Gadgets Picked

UNDER A MIDNIGHT LIGHT shed by one of the gadgets that Thomas A. Edison evolved, three judges from the National Editorial Committee sat in a room at Detroit ASTME Headquarters recently and pored over scores of modern-day ingenious devices submitted in THE TOOL ENGINEER's Gadgets Contest. The contest ran from Oct. 1 to Dec. 31, 1959, and was open only to Society members.

Spread out before the judges were entries from members of 40 chapters and from members at large . . . . from 16 states, Ontario, Quebec, Australia and Sweden . . . . from men with names from A (H. Alliston of Irvington, N. J.) to Z (A. Z. Zimmerman of Withusfield, Conn.).

Despite a wide disparity in subject matter and a confusing uniformity in excellence and publishability, the judges—after some sweat, no blood but a few gadget-tears—managed to select a dozen winners. The complete list of winners is in this month's Gadgets section, Page 79.

The winining gadgets themselves will be published in forthcoming issues of THE TOOL ENGINEER. Entries were judged on the basis of originality and usefulness to other tool engineers, clarity of illustrations, conciseness and completeness of presentation. A first prize, two second prizes, four thirds, and five honorable mentions were awarded.

First prize of $100 went to Edward D. Bennett, senior member of Northern New Jersey Chapter 14 and a tool engineer at the Elastic Stop-Nut Corp., Union, N. J. His socket setscrew orientator was deemed tops of the lot. Bennett joined the Society in 1955 when he was a student in Bridgeport, Conn.

Another Easterner, Fred J. Schneider of Lehigh Valley Chapter 83, took one of the two $50 second prizes with his device for automatically centering a rectangular part on a lathe spindle so that a hole can be machined in the part's center. Also a former student member, Schneider joined the Society in 1954. He is an engineering associate at Western Electric Co. in Allentown, Pa.

An assistant professor in charge of the machine shop at Oklahoma State University, Stillwater, took the other second-place cash with his graduating device for marking dials. Prof Henry J. Gerber, a member at large, joined the Society in 1953.

At least one of the four winners of the $25 third prizes deserves special mention for several reasons: he is a chapter chairman; he's also an old hand at winning prizes—and he probably stretched his imagination further than most!

Allen M. L. Johnson won his prize with a rubber ruler. The ruler is laid out on elastic to a suitable scale and is used as a timesaver when determining percentages of progress, cost, materials, etc., from a chart representing the total. Since the ruler stretches evenly along its length, proportions between divisions remain constant.

Chairman of Springfield (Mass.) Chapter 32. Johnson is chief test equipment engineer at Springfield Armory. He joined ASTME in 1943. Besides being a regular gadgets contributor, he took first in the magazine's Gadgets Contest three years ago.

One winner of an honorable mention award—a choice of the revised edition of the *Tool Engineers Handbook* or the *Die Design Handbook*—also took the unofficial trophy for the most entries—eight.

Statistically, Canadians and Californians shone. With only 4.7 percent of the magazine's total membership circulation, gadget-minded Canadians contributed 14 percent of the total entries. Californians alone sent in 12.3 percent of the total.

But whatever their source or subject, the entries all represent workable solutions to problems at hand. They also epitomize the extra effort and ingenuity that go into tool engineering at its best.

Members in the News

ROGER E. WAINDLE, life member of Detroit chapter, president of WaiMet Alloys Co., Dearborn, has been named to a newly created position of vice president of the technical div., Investment Casting Institute. Former president of the American Society of Tool and Manufacturing Engineers, Waindle will direct activity of ICI's technical programs, which include the development of standards for investment casting practices and alloys.

A member of Syracuse chapter since 1948, P. R. JUNOD has been appointed Philadelphia district sales manager for The Carborundum Co.'s Bonded Abrasives Div. Junod has been active in membership solicitation and fund raising for his chapter. He joined Carborundum in 1954. . . . LEWIS H. BUSSEY, Grand Rapids, has been made plant manager of the new Universal Joint Div. of Rockwell-Standard in Fairfield, Iowa. . . . EUGENE C. LITTLE, also a member of Grand Rapids chapter, will replace Bussey as master mechanic at the firm's Allegan, Mich., plant. . . . S. P. GASTON, member of Pittsburgh chapter, has been appointed assistant sales manager for Cold Finished Products, Vulcan-Kidd Steel Div. of H. K. Porter, Inc. Gaston joined the former Kidd-Drawn Steel Co. in 1950, after 10 years of metallurgical control work, and has held various positions from general plant foreman to sales manager. . . . The N. A. Woodworth Co. has appointed W. E. SANDERS, Peoria chapter, sales and service representative in the Southern Illinois and Eastern Missouri area. In 1951 Sanders established his present organization, Sanders & Lumberry, Inc.

EUGENE A. ANSPACH, past chairman of Milwaukee chapter and a member of ASTME since 1938, has been appointed works manager for George Gorton Machine Co. With many years of experience with several well-known companies, Anspach has served Line Material Industries for the past nine years as senior staff engineer.

Eugene A. Anspach

Carl R. Lindell

Formerly development engineer for automatic equipment with Hanson-Van Winkle-Munning Co., PETER ARNOLD of Monmouth chapter has been appointed Eastern sales manager for equipment by The Meaker Co., subsidiary of Sel-Rex Corp. Arnold holds patents on several inventions for conveyor type equipment and has specialized in the design and development of metal finishing processing machines. . . . JOE ZINKGRAF of Houston has become manager of machine tool sales for Wessendorff, Nelms Co. Associated with the firm as a sales engineer since 1952, Zinkgraf was formerly with Hunt Tool Co. and Hughes Tool Co. . . . FRANK KIRSTEN of Detroit chapter has been appointed factory manager for National Broach & Machine Co. Kirsten, who joined the company in 1934, was formerly general superintendent. . . . HARRY A. SKILLMAN, San Gabriel Valley, sales engineer for E. W. Bliss Co. for the past four years, has been promoted to West Coast manager of the Press and Die Supply Divs. Prior to joining Bliss, Skillman spent nine years in various sales engineering capacities for several machine tool manufacturers and also had 12 years' experience as a tool and diemaker.

ROBERT W. MILITZER, Detroit chapter, former supervisor of mechanical engineering at Micromatic Hone Corp., has been appointed chief engineer. Militzer is a vice president and director of the Detroit chapter, Michigan Society of Professional Engineers. He joined Micromatic in 1942.

CHARLES E. WHITEHEAD, program chairman of Houston chapter, has been promoted to assistant to the president of Wessendorff, Nelms & Co. Prior to joining Wessendorff in 1928, Whitehead was associated with the Texas Co., Sinclair Refining Co. and the automotive supply business. He started with Wessendorff selling machine tools and in 1939 was made manager of the company's tool sales.

Commensurate with the recent expansion of F. Jos. Lamb Co., Detroit, CARL R. LINDELL was promoted to plant manager for the company. He had been chief engineer since 1955. A member of Detroit chapter since 1944, Lindell has had 20 years' experience in machine tool design, engineering sales and manufacturing work, and his new position entails responsibility for the coordination of these.

chapter news

WINDSOR—A. E. Underwood (right), chairman of Chapter 55, and R. C. Williams (center), Canadian manager of Thor Power Tools, talk with guest speaker Donald K. Skoog, director of research at Thor, Aurora, before his talk to 175 Windsor members at the January meeting. Skoog reviewed different types of torque control equipment and the problems that arise in their use and design. Attendance at the meeting represented 48 percent of chapter membership.
—Frank Shaw

Mohawk Valley Conducts Powder Metallurgy Seminar

MOHAWK VALLEY—An investigation into powder metallurgy was carried on at the Mohawk Valley Technical Institute recently. The occasion was a day-long seminar sponsored by the Mohawk Valley senior chapter and the student members at the Institute. Invitations were extended to everyone in the area concerned with the metal trades and to members of other technical organizations. Approximately 150 persons attended the seminar.

An introduction to powder metallurgy and its applications was presented by Jacob W. Miller, supervisor in the process research section of the Remington Arms Co. Of special interest to the tool engineers in the audience was that part of the program which dealt with tooling for powder metallurgy. This was the topic covered by Peter V. Schneider, project metallurgist at IBM. The afternoon sessions consisted of discussions of presses for powder metallurgy, offered by James J. Kux, president of Kux Machine Co.; and sintering atmospheres and furnaces used in powder metallurgy, by Russell F. Novy, assistant director of research and a metallurgist at Lindberg Engineering Co.

The pressures of present-day competition demand an accelerated program for researching and developing effective manufacturing processes in the metalworking industry. Such processes must be aimed at reducing manufacturing costs and improving quality with a minimum amount of capital investment in process equipment. Powder metallurgy has been recognized as such a process, seminar registrants were told. Industry's need for trained technicians, which is rapidly increasing as the potential of the powder metallurgy technique is realized, was the motive behind this Mohawk Valley seminar.

With this recent upsurge of interest in powder metallurgy there is a general belief that the technique is relatively new. Actually, while the present process is more refined and scientific, there is evidence that iron oxide was reduced with charcoal and the resulting "sponge iron" was hammered into shape by the Egyptians 5000 years ago. Today the process represents an important method of producing structural parts from powders of a single metal, several metals or a combination of metal and nonmetallic substances.

LONG ISLAND—A complicated circuitry warrants the undivided attention of a father and his son during a tour of the Republic Aviation Corp. at Long Island. Some 420 ASTME fathers, sons and guests viewed the Republic plant and heard the firm's executive vice president, Gen. Harley S. Jones, trace the growth of the aircraft industry from 1930 to the present. In his talk Jones described the development of one of the country's most vital airplanes, the Republic F-105, which recently brought the air speed record back to the United States.
—Warren A. Lipman

Long Beach Marks First Ten Years With Society

LONG BEACH—On Jan. 13 Long Beach celebrated its first decade as an ASTME chapter. Except for new faces among the membership, the 1960 meeting bore a striking resemblance to that held back in 1950. The same guest speaker was invited back, the charter chairman was on hand and the man who, as head of the program committee, set up the whole meeting in 1950, was back this time as second vice chairman. He is E. J. Van Wagner.

James Meehan, assistant to the general manager at Brown & Sharpe Mfg. Co., returned to Long Beach as guest speaker after a ten-year absence. His 1960 topic was "Grinding to the Millionths." He explained how through the years precision limits diminish with the speed of travel. In 1900 with the speed at 25 mph, production achieved ±0.005. The speed of 120 mph in 1917 diminished limits to 0.003. By 1945, at 350 mph, the finished parts tolerance was reduced to 0.001. At a speed of 450 mph, 1951 refinement reached 0.000020. By 1958 a velocity of 1250 mph was possible and with it refinement of 0.000010 was accomplished.

Meehan also illustrated the utilization of electronics in today's fine instrumentation. "Precision is our destiny," he philosophized. With the international situation being what it is today, tool engineers are responsible for the country's protection, Meehan said. Greater appreciation of diminishing limits must be spread. To achieve our goal machine refinements must work at ±0.

The man who pioneered the formation of the Long Beach chapter, John Stansbury, was among the 75 present at the anniversary meeting. Since his chairmanship, Stansbury has been active on a number of chapter committees and projects.

A policy that has grown up within the Long Beach chapter during its ten-year history has been that of aid to and participation in community projects.. An announcement of the chapter's willingness to assist in another such project was made at this meeting. Long Beach members will work with the Community Rehabilitation Institute in solving shop problems that might arise among handicapped employees.

—Paul J. Bodnar

Attending the "Ten Years Later" meeting of Chapter 84 were (left to right) E. J. Van Wagner, guest speaker James Meehan, and John Stansbury. All participated in the chapter's first meeting ten years ago. Van Wagner and Stansbury both work at Douglas Aircraft Co., Inc.

ERIE—Members and guests inspect parts that can be deburred by barrel finishing at the January technical meeting. The display supplemented a talk dealing with the media and compounds to be used in barrel finishing presented by Donald Mosher, president of BMT Mfg. Corp. *—Andrew Plaza*

Milwaukee

The Allen-Bradley Co. played host to some 250 members and guests of Chapter 4, including several visitors from Racine, at their regular November meeting.

chapter news index

A sample of swaging is examined by three members of Chapter 148 after a talk on this subject was presented by Lloyd A. Whiting of the Torrington Co. Left to right are Henry Somma, first vice chairman; Whiting; John Cameron, chairman; and D. H. McCullough, third vice chairman.

Central Connecticut Hears Advantages of Rotary Swaging

CENTRAL CONNECTICUT — About 110 members were in Torrington for the January meeting of Chapter 148. Lloyd A. Whiting, chief engineer in the swaging division of the Torrington Co., was invited to this meeting to discuss the rotary swager as a production tool. Whiting has contributed a number of articles on swaging to trade magazines and has also been consulted to review the swaging machine section of the second edition of the *Tool Engineers Handbook*.

His talk was followed by a film which illustrated the specific applications of swaging in production. Following the film, samples of swaging were examined by the members and their questions answered by Whiting and his staff.

It was emphasized in discussing the advantages of swaging that the hammering effect has the same beneficial result as in forging, in that it produces desirable grain structure and increases tensile strength. Cold swaging work hardens most material. Hot swaging usually does not have as much effect on material characteristics, but will result in improvement of the grain structure. In fact, Whiting said, brittle materials such as tungsten develop enough elasticity after repeated swaging to permit drawing.

Another major advantage of swaging is the conservation of material. The metal is shaped by hammering. There is no waste except in jobs which require trimming on one or both ends afterwards. Swaging is fast, requiring only a few seconds for most operations.

—Arthur C. Neil

Experts Discuss High-Speed Steels

CALUMET—Spotlighting four of the leading authorities in the field, Chapter 112 presented a panel discussion on a close-to-home subject—high-speed steels—at its January meeting. On hand were a hundred members from the Calumet Area chapter, situated in a major steel producing area.

Moderating the parley was A. J. Scheid, vice president of the Columbia Steel Co. He discussed applications and high-speed steels in present-day industry. Scheid then turned the meeting over to Martin Dempsey, product metallurgical engineer at Crucible Steel Co. of America, who explained various chemical compositions, the effects of additives and varying properties such as wear resistance and toughness.

Latrobe Steel Co.'s chief metallurgist, Peter Leckie-Ewing, took another approach to the subject—heat treatment in order to achieve and maintain maximum wear and toughness. Leckie-Ewing delved into the various heat-treating methods, both salt bath and atmosphere control furnaces, maximum and minimum temperature variations, and the tempering of the complete range of today's high-speed steels.

Important when considering the requirements of the competitive high-speed steel industry is covering application. Edward Hall, manager of technical services, Universal-Cyclops Steel Co., elaborated on this aspect. He indicated the possible steels with detailed composition and applications. He also talked of single and multiple-point cutting tools, punching, hot working, interrupted cutting, and other general uses.

—J. T. Reece

Grand Rapids

"Numerical Control of a Precision Boring Machine" was the subject presented by C. R. Hibbard, sales manager of the Fosdick Machine Tool Co. at the Jan. 11 dinner meeting. Colored slides with questions and answers enhanced the members' interest.

Southern Minnesota

At the Jan. 7 meeting 60 persons heard Harry Conn., chief engineer of Scully-Jones & Co., give a talk on "Economic Effect of Modern Tools." Conn illustrated his talk with slides and showed displays as he discussed new tools and tooling concepts, as well as machining.

During a recent visit Philip R. Marsilius (second from left), ASTME national vice president, lunched with three of the main forces behind the ASTME chapter taking shape in Mexico. Pictured are (left to right) Ray A. Gast, Marsilius, Richard Johnson of the chapter's membership committee, and Julio N. Garcia, chapter secretary. Marsilius also visited several manufacturing firms which employ many of the future Mexican ASTME tool engineers.

DALLAS—Chairman Ben Harris of North Texas chapter presents National President Wayne Ewing with an honorary citizenship certificate from the mayor of Dallas, during a meeting of the South Central Council of chapters. Twenty-eight leaders from ten chapters, including Council Chairman W. E. Unruh of Wichita, attended the session. Charles K. Hay of Houston was elected council chairman for 1960.

Springs and Finishing Discussed at Two Meetings

CINCINNATI—October and November proved busy months for the members of Chapter 21. On Oct. 13, guests and members totaling 65 heard Robert White of the Dayton, Ohio, Div. of Associated Springs, Inc., lecture on design and specification of various types of springs used in industry today. Of special interest to the audience was White's mention of the fact that many designers specify expensive piano wire for springs, when other cheaper substitutes are available and just as efficient.

A tour of the new Ford Automatic Transmission plant in Sharonville was taken by 150 Cincinnati chapter members on Oct. 23. Chapter Chairman Broadus Rusk arranged the tour which gave the group a look at the latest in automation equipment.

The more recent meeting occurred on Nov. 10. Sales engineer for the Brush Instrument Co. of Cleveland, Philip J. White, discussed "Surface Finish Control." Brush instruments measure surface roughness, waviness and lie accurately, White stated. Surface finish in the low microinch is expensive; therefore, design should specify as coarse a finish as is feasible for its function, he revealed. He mentioned that one automotive firm was running into difficulties with its engines by specifying such a fine two-four microinch on cylinders and pistons that lubrication was not possible at high velocity and friction caused damage to the cylinder blocks. —*Clarence Keller*

Student Chapter 29 Chartered at McKeesport Campus of Penn State

McKEESPORT, Pa.—With the city mayor, a national officer, a Headquarters representative, and a pair of dignitaries from the sponsoring senior chapter present, the January chartering of the McKeesport student chapter was an eventful occasion.

The McKeesport campus, an extension of Pennsylvania State University, provided 32 young members for the Society. National Vice President William Moreland was on hand to swear the officers in and to present the charter. Andrew J. Jakomas, mayor of McKeesport, welcomed the ASTME visitors and in a sense welcomed the students to the Society. Gilbert Seeley, ASTME education director, befriended the students by presenting their treasurer with the usual check provided a new chapter to help set it on its feet financially.

Representing the Pittsburgh ASTME chapter at the chartering were Walter B. Kiefer, vice chairman of the National Membership Committee, and Raymond J. Zale, chairman of Chapter 8. Pittsburgh was the sponsoring chapter for the McKeesport group.

The new officers of the student chapter are: Chairman Donald C. Morian; Vice Chairman John S. Stefanyak; Secretary Emerson A. Snee; Treasurer Joseph J. Perun, and Faculty Adviser Charles B. O'Toole, an instructor in engineering at the school.

'Logical Approach' To Tapping Offered

NORTHERN MASSACHUSETTS—"A Logical Approach to the Tapping Problem" was the subject of a talk at the Dec. 15 meeting, where 110 members and guests heard Wayne C. Hitchcock, methods and application engineer of Butterfield Div. of Union Twist Drill Co. Hitchcock discussed both design and application of taps in connection with tapping high temperature alloys and superstrength steel.

Two things of importance in the design and application of taps, he said, are the hardness of the material and microstructure. The most important fact to the tap user is the cost per hole, which in turn would create the following points of interest to the tap manufacturer: material, equipment, the tap and the lubricant. With the aid of color slides Hitchcock showed how different types of taps affect torque in in/lb. He said that the lower the tapping torque, the higher is the tap efficiency, resulting in longer tap life. —*Richard I. Edwards*

Member of ASTME Exposition Committee, Carl Leska, Dies

CLEVELAND—Carl J. Leska, 43, a member of the three-man National Exposition Committee of ASTME and a past chairman of Cleveland Chapter 3, died on Jan. 8 at his home in Shaker Heights after a long illness.

Leska was divisional manager of the power systems works of the Tapco group, Thompson Ramo Wooldridge, Inc., manufacturer of aircraft and missile parts and other products.

A native Clevelander, Leska held an engineering degree from Fenn College and a master of arts from Western Reserve University. For years he taught tool engineering at Fenn's night school.

He first joined the Society as a student member in 1938.

Survivors include his wife Mildred; two children, Sally and Robert; and his father, Joseph Leska.

Monadnock

Chapter 124, with 134 members present, held a Suppliers Night for the first time since its chartering February 1955. Displays and demonstrations were used to show products and their applications by 13 suppliers.

Indianapolis

At the November meeting of Chapter 37, Harold E. Collins, director of Hughes Tool Co. and manager of foreign operations, told 90 members of the threat of foreign competition in the machine tool industry in the United States, emphasizing the fact that their machines compared favorably with those of U.S., but were sometimes better and lower in price.

200 Canadians Gather From Four Chapters To Tour Machinery Plant

GRAND RIVER VALLEY—Chapter 81 held its most successful plant tour to date on Jan. 21. Over 200 members and guests were conducted through Canada Machinery Corp., Ltd., located at Galt, Ont.

CMC representatives guided groups of ten through every department in the plant which covers 218,000 sq ft of production floor space. The company, which had its beginning in 1872, is known throughout industry for its lathes, shapers, woodworking machines, and railway anchors.

Besides those from Grand River Valley, members from three other Canadian chapters toured the plant. Represented were the Windsor, Hamilton and Toronto chapters.

The regular January chapter meeting was held on Jan. 8 with 83 members and guests present. At that time Sulo M. Hutko, tool engineer and owner of Shanfield Industries, Ltd., Toronto, was featured as speaker. He spoke on "Steel Rule Dies and Their Manufacture."

—Hermann Rochau

George Churchill (third from right) of the National Program Committee listens while Ken Baird, first vice chairman of Chapter 81, does his best to explain why Churchill did not receive that chapter's monthly bulletin. Watching at the left are Jack Wagner of Canada Machinery Corp., Ltd., the scene of the friendly dispute; and Russ Wilson, Hamilton chapter third vice chairman. Hamilton Chairman Bill Durrant and Perc Bowman, Chapter 81's chairman, observe on the right.

Automatic Control Advantages Heard

NORTHERN MASSACHUSETTS — According to David N. Smith, chief development engineer at Jones & Lamson Machine Co., automatically controlled machines are becoming increasingly more popular among manufacturers. Smith elaborated on his belief at the January meeting of Chapter 100. Attendance at the meeting totaled 107.

The reason for this spreading popularity lies in a number of factors, he said. Automatically controlled machines have an in-process gaging and an automatic self-regulating device. Smith showed by means of tape-controlled turret lathes that setup time is drastically reduced, thus small-quantity lots become more economical. He proved that automatically controlled machines pay for themselves in a relatively short period of time. With automation direct labor decreases, but plant costs increase due to the installation of the new machinery. However, the costs of this machinery are quickly absorbed.

As a typical example, Smith cited one case where an automatically controlled machine had been running for more than two months, 24 hours a day, seven days a week, and had produced more than 1,250,000 holes. Every hole was within tolerance.

—Richard I. Edwards

EVANSVILLE—Shell moving versus green sand molding was the featured topic at the January meeting. The three guest speakers from the Lakeshore Div. of Bendix Aviation Corp. pose here with two Chapter 73 executives. Left to right are Louis Luker, program chairman; R. W. Ayers, Bendix sales representative; Charles Hinman, chapter chairman; A. A. Johnston, master mechanic; and E. C. Zuppman, foundry manager.

—Earl R. Crowe

SEATTLE—Following a meeting attended by 125 members of Chapter 39, (left to right) Calvin Jones, program chairman, and Gordon Duncan, chapter chairman, thank guest speakers, Hans Weder of Charmilles Engineering Works Ltd., Geneva, Switzerland; and Arnold Y. Young, sales manager at Engis Engineering Co. Weder discussed new equipment for electroerosion machining and Young spoke on optical tooling.

—Ralph F. Ingebretsen

Examining the list of Chapter 95's new officers at the January meeting are (left to right) Charles McNealy, advertising chairman of Long Beach chapter; George Tilden, first vice chairman of Los Angeles chapter; James Medford, past chairman of Long Beach chapter; and Rudolf Regen, parliamentarian of San Fernando chapter and chairman of the 1960 Western Tool Show.

San Gabriel Holds Early Elections

SAN GABRIEL—Granted special permission by National Headquarters, Chapter 95 selected its officers for the 1960-61 term earlier than usual at a January meeting. Some 86 members attended the election night affair.

Since their February meeting will be devoted to a joint session with the local chapter of the American Society of Quality Control and the Pasadena City College student ASTME chapter, San Gabriel was given the go-ahead on the early officer election. The new officers are: Jack Bailey, chairman; Hank Schierhold, first vice chairman; Kenneth Allen, second vice chairman; Ray Donaldson, third vice chairman; George C. Evans, secretary; and Charles Booth, treasurer. Russ Stainton, outgoing chapter chairman, offered his congratulations to the new executives.

Invited to this meeting were officers of several neighboring ASTME chapters. Representatives from the Long Beach, San Fernando Valley, and Los Angeles groups gave their full approval of the men chosen by the San Gabriel members to govern that chapter's activities during the coming year.

—Bernard K. Allen

New Ogden Chapter Starts Scholarship

OGDEN, Utah—A $500 scholarship will be awarded annually to an honor student from one of the Ogden area high schools by the recently chartered ASTME chapter. Syd Parsons, chairman of Chapter 156, said the first scholarship would be presented this spring.

Under the award plan, the recipient will choose his own college and field of study. However, preference will be given to students interested in engineering. The scholarship fund, Parsons announced, will be financed from dues of affiliate members of the chapter. Affiliates include Tool Research, Inc., Commercial Consultants, Inc., H. I. Thompson Co., Weber College and Marquardt Corp.

The Ogden chapter, which was chartered in 1959, has 154 members representing nine firms in northern Utah.

The chapter has also started a program to honor outstanding students at local high schools. Honor students are special guests at chapter meetings. The chapter works closely with ASTME Student Chapter 2 at nearby Utah State University, which was the second student chapter to be organized in the United States.

—Verl Graser

Barrel Finishing Is Boston Topic

BOSTON—A hundred members of Boston chapter were urged at their December meeting to take the attitude that "a part that is machined economically must also be finished economically," if they are to fulfill their obligations as tool engineers.

In a talk on barrel finishing, President Donald Mosher of the B.M.T. Mfg. Corp., Elmira, N. Y., declared there is an ever increasing interest in precision barrel finishing as a manufacturing process with high savings potential. He told of one company that had one man trained for one week, installed barrel-finishing equipment in their plant in April, and by the end of the year had registered a $62,500 drop in deburring costs—along with a 7 percent increase in business.

"The process is as important as any machine in the production line," Mosher said. "It can be considered as a machine tool, in fact; it can be said that the barrel is the holding fixture, the abrasive is the cutting tool and the compound is the cutting fluid. By drawing this parallel, one must say it is definitely a part of tool engineering."

He emphasized the shortage of personnel—persons with a basic knowledge of metallurgy, chemistry and the fundamentals of production tooling—who are adequately trained in the technique. He traced the principle of barrel finishing back to the days of chivalry, when the armor plates of knights were placed in a barrel and rolled across the courtyard to clean and polish the metal.

—Les Horne

Members of Six Chapters Join in Ithaca Tour

ITHACA—A joint plant tour sponsored by Ithaca and Elmira chapters attracted 135 members and guests to the host plant, the Morse Chain Co., on Dec. 7. Besides Elmira, members came from Buffalo, Syracuse, Rochester, Binghamton and Hammondsport.

In groups of ten, the visitors viewed the 430,000 square feet of floor space devoted to manufacture of drive chains, timing chains, mechanical power transmission components, and so on. They saw the start-to-finish production of drives ranging from the tiny ones used on power sewing machines and moving-picture projectors to those transmitting thousands of horsepower in large rolling mills. Of especial interest were the automatic chain-laying machines, completely assembling the products in one process, and the large punch presses in operation.

—Anna B. Gage

SPECIAL EVENTS

Second Annual Production Institute	Mar. 21-22, '60	University of Wichita Wichita, Kan.
ASTME 28th Annual Meeting and Engineering Conference	Apr. 21-28, '60	Statler-Hilton and Sheraton-Cadillac Hotels Detroit, Mich.
ASTME Tool Show	Apr. 21-28, '60	Detroit Artillery Armory Detroit, Mich.
ASTME Western Tool Show	Nov. 14-18, '60	Memorial Sports Arena Los Angeles, Calif.

CALIFORNIA STATE POLYTECH—Robert A. Edgcomb (center), first vice chairman of the San Fernando Valley chapter and owner of the Edgcomb Engineering & Engraving Co., demonstrates a scale which can be mounted on any type of metalworking machine to indicate the length of a cut. Holding the other end of the scale is Instructor Kaye of the Edgcomb machine shop. Looking on are (left to right) James Barth, Student Chapter 12 chairman; Francis Whiting, student chapter adviser; and Rudolf Regen, also of the San Fernando Valley chapter, who is chairman of the 1960 Western Tool Show to be held in Los Angeles. —*Leonard H. James*

Peoria Meeting Features Tape-Control Experts

PEORIA—Held at the Bradley University student center, Chapter 31's December meeting featured W. E. Brainard, chief engineer at Kearney & Trecker Corp. and John Joerger, sales manager of the same firm, as guest speakers. The program, which was planned by the student branch of the Peoria chapter, attracted 130 persons.

The theme of the meeting was "Milwaukee-Matic Tape-Controlled Machines." Joerger presented slides of an automatically controlled machine in action and data on the operation of its mechanical equipment. He passed examples of parts machined on a Milwaukee-Matic among the members of the audience. Brainard told of the practical aspects of the machine—what types of jobs should be routed to it, determining operational costs and the possible reduction of said costs by the use of tape-controlled machines.

The meeting's technical chairman was Keith Millard, supervisor of machinist training at Caterpillar Tractor Co. —*Vince Ekiss*

Positions Available

MANUFACTURING AGENTS—Diamond Wheel manufacturer requires active and progressive representation; several choice territories available. Products include resinoid and metal bonded wheels, also wheels for electrolytic grinding. All products fully guaranteed. Write Diacraft, Inc., 26538 West Seven Mile Rd., Detroit 40, Mich.

TOP-NOTCH POSITION for high-grade, experienced man; salary open. Qualifications: mechanical engineer, age 35-40, sound background in forging, machine shop, finishing, heat-treating, methods, etc. Supervise plant of about 200 men, factory and home office in Owatonna. OTC—manufacturers of maintenance tools, hydraulic pumps, presses, etc. All replies confidential. Send resume to Walter Hertz, Owatonna Tool Co., Owatonna, Minn.

DESIGN ENGINEER—Outstanding company in special-purpose machine field. Expansion minded. Two modern plants. Latest equipment. Excellent customer and employee relations. We seek a qualified engineer to assume full responsibility for design and development of standard machine components and special machinery particularly in assembly field. Must be experienced, creative, and able to work with minimum supervision. Complete company benefits program. Salary open—commensurate with experience. Please send complete resume and salary requirements to Classified Ads, Dept. 171, 10700 Puritan Ave., Detroit 38, Mich.

TAP SERVICE ENGINEER—rapidly expanding tap manufacturer desires a man with deep understanding of tapping problems and their solutions. Must be willing to travel. Top salary and company benefits. Write giving full details of background, salary requirements. Write to Classified Ads, Dept. 173, 10700 Puritan Ave., Detroit 38, Mich.

APPLICATIONS ENGINEER—Machine Tools. For study of new electron-beam machining process and investigation of its application to new processes. Study of customer requests, investigating and adapting electron-beam process to customer applications. Reply to Mr. R. A. Fuller, Dept. 30, Hamilton Standard, Div. of United Aircraft Corp., Windsor Locks, Conn.

DEVELOPMENT TEST ENGINEER (Mechanical)—For development work on machine tool mechanical aspects of the electron-beam machine. Must have good experience in complex specialized machine tool engineering and development, with emphasis on advanced mechanization and automation. Reply to Mr. R. A. Fuller, Dept. 30, Hamilton Standard, Div. of United Aircraft Corp., Windsor Locks, Conn.

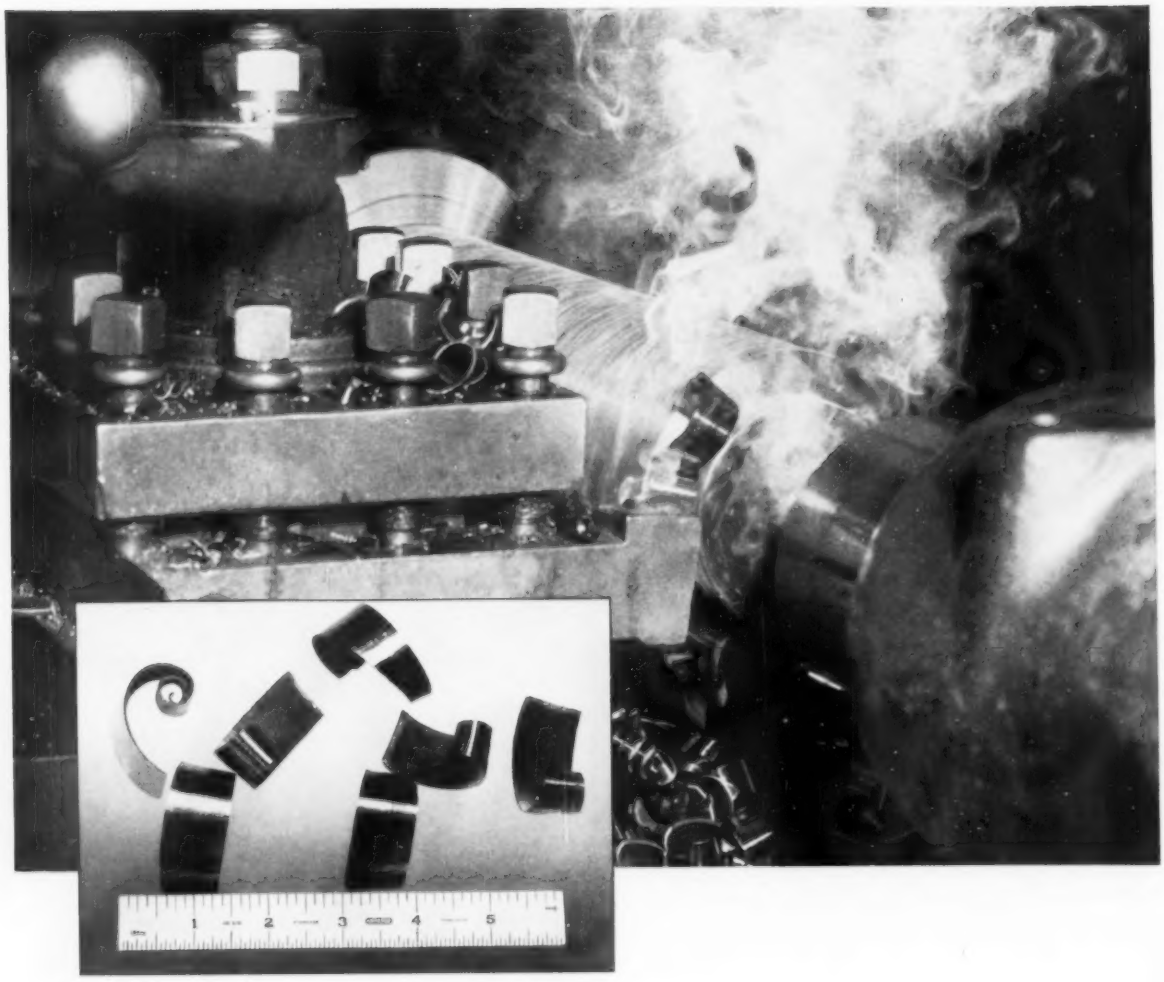
APPLICATIONS PROJECT ENGINEER—for advanced electronic development work in improving electron-beam technology. Reply to Mr. R. A. Fuller, Dept. 30, Hamilton Standard, Div. of United Aircraft Corp., Windsor Locks, Conn.

CUTTING TOOLS SPECIALIST—rapidly expanding company has a proposition to make if you are an aggressive manufacturer's representative with a sound background in cutting tools, and understand new and dynamic merchandising ideas. Write today giving full details of background and territory covering. Write to Classified Ads, Dept. 172, 10700 Puritan Ave., Detroit 38, Michigan.

DESIGNERS—Machine Tools. For design of mechanical, hydromechanical or electromechanical components and controls for new machine tool. Requires thorough familiarity with machine tool concepts and applications, with emphasis on advanced mechanization and automation. Reply to Mr. R. A. Fuller, Dept. 30, Hamilton Standard, Div. of United Aircraft Corp., Windsor Locks, Conn.

Position Wanted

MANUFACTURING ENGINEER—Industrial and mechanical engineering background. Experience in methods improvement, plant layout, process, tool, die and special machine design. Cost estimating experience on stampings, assemblies, tools and special machines. Have written engineering articles. Former sales engineer with excellent and diversified contacts. Prefer Detroit or vicinity location. Write to Classified Ads, Department 170, 10700 Puritan Ave., Detroit 38, Mich.



Chips like these boost machine output at HEWITT-ROBINS

The ability of VR-77 on heavy interrupted cuts gives Hewitt-Robins maximum machine output per dollar of machine investment. At their Robins Conveyors Division Plant in Passaic, New Jersey, VR-77 is used for maximum metal removal on 1045 cold rolled steel, taking a 0 to ⅞" cut at 300 s.f.p.m. with a .026" feed. Downtime has been cut in half because VR-77 removes twice as much metal per index as the previously used carbide brand.

Regardless of your particular machining problem, there's a V-R carbide specifically engineered to help you boost your machine output.

Send for Catalog VR-58 for complete details.

CREATING THE METALS THAT SHAPE THE FUTURE

V-R VASCOLOY-RAMET

806 MARKET STREET • WAUKEGAN, ILLINOIS

C-773

Progress in Production

STEEL STRIKE STIMULATES USE OF CHEMICAL MILLING

Chemical milling, the controlled removal of metal by chemical action, received an unusual stimulant by way of the late steel strike. During the strike it was impossible to obtain steel sheet of required size and thickness for one of the missile programs. To solve the problem Chemical Contour Corp., Gardena, Calif., assembled twenty-five thousand pounds of available steel panels which were then chemically milled to correct gage and size. Two weeks time was required to chemically mill the steel during which time two and one-half tons of stock were removed.

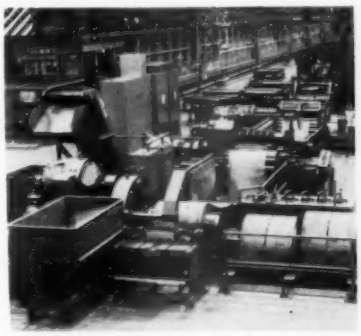
Chemical milling in the past has been associated mostly with aluminum. However, chemical milling as performed during the steel strike places steel in the aluminum category, as far as industrial processing is concerned. This fact is particularly significant because the use of steel in the manufacture of high-performance aircraft and missiles is increasing. Although heavier than aluminum, steel alloys are superseding aluminum in some areas of aircraft design because of their superior properties of heat resistance. To help offset its weight disadvantage, every ounce of steel not essential to structural strength is removed.

In the chemical milling process, the material to be "machined" is immersed in a large tank containing etching solutions. Rubber materials are used to mask areas which should not be etched. Timing, of course, is critical to success of the operation.

NEW SLITTING LINE IMPROVES QUALITY OF SILICON STEEL COILS

Manufacturers of electrical equipment have found difficulty in slitting silicon steel coils without destroying the metal's electrical properties. At Westinghouse's plant in Athens, Ga., this problem has been overcome by installation of a specially designed Wean slitting line. The line, designed jointly by Westinghouse and Wean Corp. engineers, has a number of features intended to insure efficient and careful handling of coils at every stage of the slitting operation.

In operation, as the steel uncoils, it feeds into a loop and is pulled into the slitter by a driven arbor on which the slitting knives are mounted. As the strands leave the slitter, they feed into a second loop before entering the recoiling department. The use of entrance and exit loops makes this slitter different from standard carbon steel slitters which maintain uniform tension on the strip. The loops isolate the coil from tension which may exist in other parts of the line. As well as an absence of tension, a second important difference between this and standard slitters is that the knives are driven constantly.

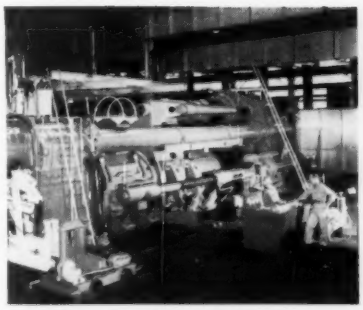


Portion of slitting line. Design of line makes it possible to slit silicon steel coils without destroying the electrical properties of the metal.

The recoiler makes use of a patented overarm separator instead of conventional separator disks. This eliminates time and effort required for removal and replacement of individual disks. It also eliminates a possible source of damage to strip edges.

GIANT PRESS EXTRUDES ALUMINUM FOR CIVILIAN USE

Aluminum extrusions of extreme lengths and weighing as much as 2500 lb are now being produced on a 14,000-ton extrusion press at the Lafayette, Ind. plant of Alcoa. With the expanded extrusion capacity provided by the press, Alcoa will produce seamless pipe with outside diameters of 20 inch and greater. Other products scheduled to be produced are tubes for masts and booms in merchant ships; large sections for highway trailer flooring; hatch covers; hydrofoils; deckhouses and structural shapes requiring parts built up from small pieces.



Press for extruding aluminum for civilian consumption. Similar press was built earlier for military use.

Components of the new press include castings weighing up to 120 tons. To insure accuracy of press assembly, optical alignment techniques were used.

HIGH PRODUCTION MACHINE AUTOMATICALLY DRILLS, REAMS, TAPS TRANSMISSION CONTROL VALVES

Die cast automatic transmission control valves are drilled, reamed and tapped automatically by a new machine manufactured by The Morris Machine Tool Co., Cincinnati, Ohio, for a major automobile manufacturer. The horizontal rotary indexing machine utilizes a 36 in. diameter table and a 10-station automatic hydraulic index to process 188 pieces per hour at maximum rate.

Nine auxiliary units are mounted on the platen of the machine. Eight of these are horizontal drilling units and the ninth is a horizontal tapping unit. The fixture holds one workpiece which is manually clamped and automatically unclamped.

The machine eliminates model change-over problems by incorporating standard production units. Fast, easy realignment of the machine is possible for product model changes, for completely new models, or for other types of products within the size limits of the equipment.

The bushing brackets of the machine are movable type and register in each

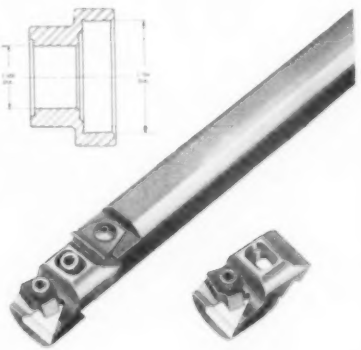
fixture. The register bushings in each fixture are jig bored with respect to the locating points of the part; accuracy required on center distances is easily attained. As a further aid to accuracy, the multiple spindles of the tap head are all geared to the lead screw, producing an extremely accurate thread.

The coolant system is built into the base of the Morris machine, minimizing coolant lines and giving better control of coolant flow. A safety switch requires that the part be properly located in the fixture and clamped before the table will index.

THROWAWAY INSERTS ELIMINATE TOOL GRINDING COSTS

A survey of methods and costs related to the boring of transmission gear blanks in a major automobile plant has resulted in a change from multiple insert boring heads to "throwaway" insert tooling. Operations on the gear blanks consist of rough and finish boring a 2.784-in. diameter and finish boring a 1.584-in. diameter.

The survey was prompted because



Cross section of transmission gear blank (above). Insert boring bar now used in machining the gear blank (below).

of the expense incurred in grinding boring-head blades. To recondition the blades, it was necessary to remove the heads from the machine, an eight-spindle Acme-Gridley automatic. Regrinding and resetting of blades required an average of 5.7 hr per day at a cost of $2.97 per hour.

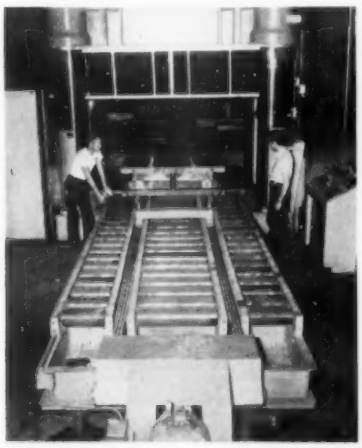
An additional problem imposed on the operation by the use of multiple-blade boring heads was chip accumulation. Because of this accumulation, it

was necessary to stop production every five to ten cycles to clean out the heads.

Both problems were eliminated by Kendex single-point "throwaway" tooling. Tool costs were dropped from five cents to one cent per gear blank. Substantial increase in production was also effected by the decrease in downtime.

DIE HANDLING TABLE LOADS, UNLOADS

A large die-handling table, designed and produced by The Colson Corp., has simplified production of the Nike-Hercules missile airframe at the Charlotte, N. C., Division of the Douglas Aircraft Co. With a capacity of 30,000



Die table for loading and unloading dies. Use of table speeds die movement, freeing overhead crane for other work.

lb, the table feeds and removes a variety of dies for the beds of two large hydraulic presses used in Nike-Hercules construction. It has replaced use of an overhead bridge crane for die loading, always an awkward procedure because it requires dies to be swung into place. With the die-handling table, entry and exit are accomplished on the same level as the press bed. In operation the table hooks into the front of the press. Dies are then hoisted onto the table and secured to a bar at the power end of the table, which is away from the press. This bar pushes the dies over the table's rollers into the press. The procedure is reversed in removal of the dies.

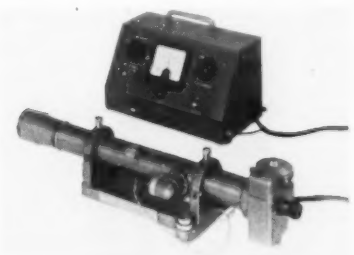
Table power is electric-hydraulic: capacity is 18 ft by 6 ft. Correct height and leveling is obtained by adjusting the table's screw legs and jacks.


JACOBS BALL BEARING SUPER
No 14N CAP 0-1/2
Jacobs
means precision
where you need it most
. . . at the work
INDUSTRIAL DISTRIBUTORS
JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONNECTICUT

TOOLS of today

Microptic Autocollimator

A photo-electric system eliminates need for repeated observation through the eyepiece when making exact settings with the microptic autocollimator. All essential optical features of



the instrument have been retained. It can be used wherever the visual instrument has been applied for precise testing of angles, circular divisions, straightness, flatness and general alignment.

The electronic read-out, operated from a photo-electric cell at the eyepiece, is shown on a self-contained meter unit. The instrument is of use in testing operations such as the checking of gears, dividing heads and rotary tables.

A conversion unit photo-electric reading is available for recent model instruments.

Engis Equipment Co., 431 S. Dearborn, Chicago 5, Ill. **Circle 350**

Magnetic Separator

Developed for use with automatic and semi-automatic submerged arc welders, a magnetic separator improves welder performance and weld quality by removing from submerged arc welding flux contaminating materials accidentally picked up in handling or use.

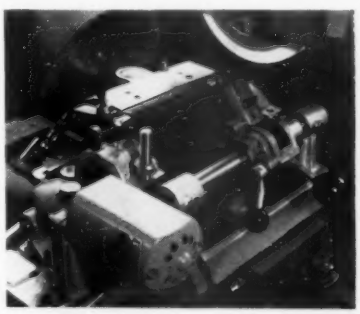
The separator—a funnel used to fill the flux container of the automatic welder—contains three cylindrical alnico magnets. It is designed for use with mild steel and low allow steel fluxes.

The Lincoln Electric Co., Cleveland 17, Ohio. **Circle 351**

Grinding Fixture

This Mini-Grind fixture, which is used on surface grinders, makes it possible to grind external diameters in any form within a size range from 0.005 to 3.5 in. No chucking or indicating is required to hold absolute concentricity and size.

The fixture is adaptable for grinding step or spherical diameters, tapers, punches, valves and other forms. It has a direct drive variable speed meter



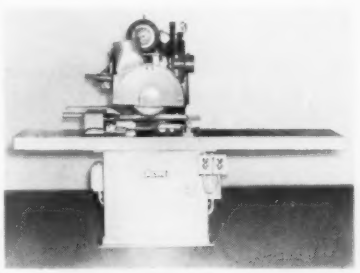
and a complete cooling system plus an adjustable torsion clamping device that locks in a positive position.

Products Supply Co., 1178 Woodward Heights Blvd., Ferndale 20, Mich. **Circle 352**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Polishing, Buffing Machine

Round, square, hexagonal or octagonal tubular metal parts can be finished with this automatic polishing and buffing machine. The unit can also be used for automatic deburring operations on tubular parts or parts having holes that enable them to be chucked on a mandrel.



The machine can be provided as a single unit or with separate reciprocating table and adjustable head units. Standard models have a maximum table travel of 48 in. and can handle parts up to 42 in. long.

Acme Mfg. Co., 1400 E. Nine Mile Rd., Detroit 20, Mich. **Circle 353**

Numerical Control System

Complete, tape-programmed control of stock positioning, stock cutoff, punch selection and punch actuation is provided with a numerical control system for high-speed punch presses.

Operating from a punched paper tape, the system directs the positioning of stock in the press, opens and closes the stock clamps, and actuates the appropriate punches and cutoff dies. All press functions have closed-loop, interlocked digital control.

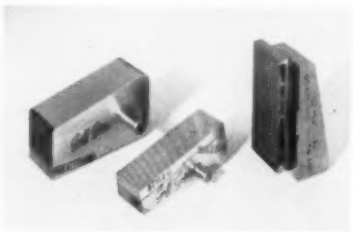
TOOLS of today

Stock feed rates up to 80 ips can be handled with accuracy by a servo loop, with error compensation for successive positioning.

Auerback Electronics Corp., 109 N. Essex Ave., Narberth, Pa. **Circle 354**

Disposable Grip Inserts

Use-tested by industrial manufacturers, replaceable inserts for grips on pull testing machines—used to test the tensile strength of metals—eliminate expensive replacement of entire solid block grips.

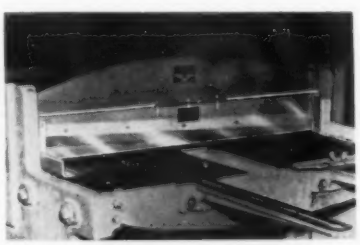


"Griff Grips" are available in three sizes: Style G for 8000-lb holders, Style H for 10,000-lb holders, and Style E for 20,000-lb holders. Custom inserts are available on special order.

Griff Machine Products Co., 137 Julius St., Pittsburgh 6, Pa. **Circle 355**

Shear Guard

Transparent Plexiglass is used for shielding 30 to 36-in. metal squaring shears. The guard is adjustable for all metal thicknesses used in shear operations and permits cutting any length or width up to the listed nominal cutting length safely and with full visibility.



The "Ful-Vu" guard is ¾ x 4 in., fastened to the side blade housings at each end of the shear frame, and located ⅜ in. above the shear table top.

Brett-Guard Corp., 456 Nordhoff Place, Englewood, N.J. **Circle 356**

Arc Welder

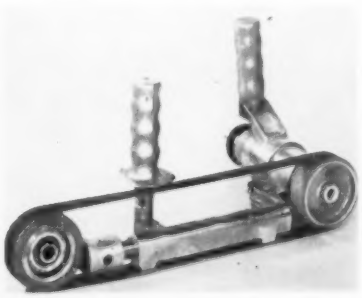
Dial type control provides easy positive setting of output over a wide amperage range in this 180 amp arc welder.

Electrodes to 5/16 in. can be used for welding materials from 20 gauge to ½-in. plate. The welder will operate with mild steel, low-alloy steel, and 18-8 type stainless steels. Light-weight construction and single phase power supply permit easy portability.

The Lincoln Electric Co., Cleveland 17, Ohio. **Circle 357**

Portable Belt Sander

Abrasive operations requiring slack of belt, contact wheel or platen can be handled with an air-powered unit using a 1 x 36-in. belt with a speed of 4500 sq ft per minute.



The portable unit may be hand held or bench mounted. It is designed for heavy stock removal as well as polishing and blending and can be used on all materials including ferrous and nonferrous metals, fibre glass and plastic, and for woodworking.

Nu-Matic Grinders, Inc., 8224 Carnegie Ave., Cleveland 3, Ohio. **Circle 358**

Metal Bond Adhesive

Adaptable to both sandwich structures and metal-to-metal bonds, Metlbond 406 is an unsupported, calendered tape, supplied in rolls 18 in. wide. It is easily cut and trimmed to shape, dry and pliable. At elevated temperatures it softens and flows, wetting the bonding surfaces. With the continued application of heat and moderate pressure, the adhesive cures into a tough, high-strength film capable of maintaining bond strengths at temperatures up to 200 F.

The adhesive weighs approximately 0.050 psf, and produces a bond line of approximately 0.005 in. after cure under vacuum bag pressure.

Narmco Resins & Coatings Co., 600 Victoria St., Costa Mesa, Calif. **Circle 359**

Stainless Steel Shim Stock

Premeasured stainless steel shim stock, Roblinger P.M.C. 60-in. long coiled stock is calibrated in ½ and 1-in. increments.

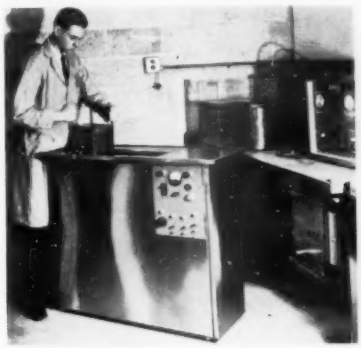
Packaged in a self-dispensing box, the stock edge shows remaining inches after cutting. Applications include shimming, jigs, tools, fixtures, patterns and machinery, stampings, washers and electronic parts.

Fabricated from Type 302 rolled full hard-spring temper stainless steel, the stock is available in nine sizes from 0.002 through 0.010-in. material thickness.

N. E. Slavin and Co., 40 E. Cross St., Somerville, Mass. **Circle 360**

Ultrasonic Degreaser

Model AC-25 Sonogen removes metal chips, grease and insoluble oils from



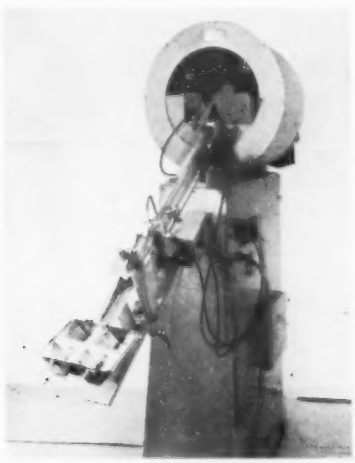
standard and intricate parts. Small motors, electronic subassemblies and bearings can be processed without disassembly.

Branson Ultrasonic Corp., 40 Brown House Rd., Stamford, Conn. **Circle 361**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electronic Parts Sorter

An electronic sensing device registers orientation of parts and diverts them into the proper receptacle after they are fed from the hopper, partially oriented and singly released into a nest.



The sorter can be used to orient and feed parts directly into a centerless grinder, machining or assembly operation and can also be used to orient and stack parts for subsequent operations. The unit is adjustable to parts of varied size and shape.

U.S. Engineering Co., 40-24½ 22nd St., Long Island City 1, N.Y. **Circle 362**

Portable Coolant Pump

Light weight, low profile construction provides easy portability of this coolant pump. The 300 rpm fan cooled

motor delivers 190 gal per hour at a 4-ft head. The non-corrosive adjustable pump is mounted on a 2½ gal tank. Plastic hose is 12 ft long.

The Dunham Tool Co., Inc., New Fairfield, Conn. **Circle 363**

Disposable Cutters

Throwaway carbide insert milling cutters, available in the 792 styles and sizes of standardized face mills, are held in precision, hardened tool steel cartridges mounted in standard cutter bodies. Cartridges of the same shank

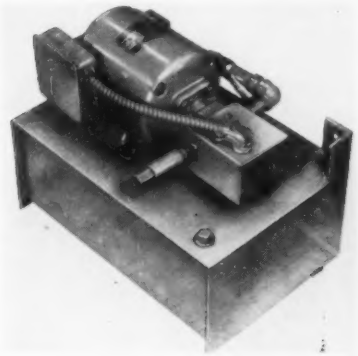
size are interchangeable. Disposable inserts eliminate regrinding and setting and provide optimum tooling geometry.

V.M.U. cutters use a Shell mill arbor mount, Ingersoll style drive or optional National standard drive. Cartridges are adjustable to read ±0.002 inch.

Valenite Metals Div., The Valenon Corp., Royal Oak, Mich. **Circle 364**

Hydraulic Power Unit

Adaptable for presses, machine feeds, lift tables, pushers and punchers or for intermittent jog type applications, the "Auto-Power" unit provides 1½ gpm output at 2000 psi.



A gear pump is coupled to an electric motor capable of producing up to 3-hp output. Adjustable relief valves, ball check valves and removable screen suction filters mounted on a 4½-gal oil reservoir are built in. Optical accessories are available.

Autoquip Corp., 1140 S. Washtenaw, Chicago 12, Ill. **Circle 365**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electronic Auto-Collimator

Checking flatness of surface plates, straightness of machine tool ways, run-out of precision bearings and monitoring drift of gyros can be accurately done with an electronic autocollimator which reads angles directly to a sensitivity close to 1/50 of a second.

The sensing unit, which has an indicating range of 50 sec (± 25 sec), transmits the signal (angular deviation) through the amplifier to the remote indicating unit by cable. A chart

recorder can be used to provide a permanent record or the signal can be fed into a Servo-mechanism or computer.

Keuffel & Esser Co., Third and Adams Sts., Hoboken, N.J. **Circle 366**

TOOLS of today

Vacuum Probe, Transducer

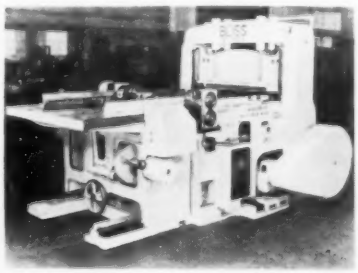
Handling of assembly or inspection is facilitated by this vacuum probe which is used to pick up and position small parts. The vacuum provides a

strong, even pressure that can be adjusted by changing the plastic tips by which the parts are held, or by a regulator installed in the air line. Vacuum is obtained from a "vacuum transducer" powered by shop compressed air supply.

The Air-Vac Engineering Co., Old Stratford Rd., P.O. Box 27, Shelton, Conn. **Circle 367**

Scroll Shear

High-speed, automatic production of scrolled strips used in the manufacture of can ends, screw caps and similar enclosures is increased through the elimination of the idle stroke between sheets with this No. 1103 shear.



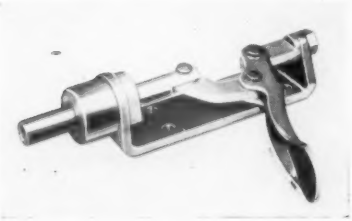
With a capacity for shearing sheets up to 36-in. square, the machine is fitted with trimming cutters that can be ground in place by means of a standard slitter cutter grinder.

Cam-activated side gages on the first table adapt the shear to lithographed or plain sheets. Magnetic feed bars and hardened back gages provide precise registry of the sheet for each cut.

E. W. Bliss Co., 1375 Raff Rd., S.W., Canton 10, Ohio. **Circle 368**

Swivel-Handled Toggle Clamp

For use where clearance requirements do not permit using conventionally designed clamps, this plunger type toggle clamp has a handle that swivels in a 220-deg arc. It can be fixed in any position within the arc by a lock-nut.



Rated holding pressure of the Model 606 clamp is 450 lb. A tapped hole in the plunger allows the use of an adjusting spindle for extending its reach. Base of the clamp is $1\frac{1}{8}$ in. wide. Overall length, with plunger extended, is $6\frac{1}{2}$ in. Plunger travel on a complete stroke is $1\frac{3}{8}$ in. Height from base to centerline of the plunger is $\frac{7}{8}$ in.

Detroit Stamping Co., 340 Midland Ave., Detroit 3, Mich. **Circle 369**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electric Comparator Gage

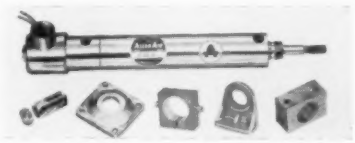
Gaging units that indicate the passing of tolerances by flashing lights detect off-size or correct size conditions within 20 millionths of an in.

The gages are accurate, provide rapid inspection at closest tolerances, have a low initial cost, and eliminate installation and high maintenance costs.

Scherr-Tumico Co., 200 Lafayette St., New York 12, N.Y. **Circle 370**

Valve-in-Head Cylinders

Three-way solenoid valves are built into the rear heads of these single acting cylinders. Model AVSA is designed for gravity or air return. Model AVSR had a rod-returning internal spring. Barrels and heads are brass and rods are stainless steel.



Both models are available in a range of voltages. A choice of four mounts is offered as well as a rod clevis.

Allenair Corp., 255 E. 2nd St., Mineola, N.Y. **Circle 371**

Solid Lubricant

Suitable for slow moving parts under heavy loads and for surfaces which would be reactive with additives, Molykote M-55-Plus is a Molybdenum disulfide lubricant for extreme pressure applications on drills, taps, cold metal forming dies and punches.

The improved lubricity of the product, and its ability to "plate itself out" on metal surfaces, makes it useful also in lightly loaded wear reduction applications in sleeve bearings and instrument gears.

The lubricant is usable in mist type lubricators and is recommended as an additive in drawing oils, tapping compounds, gear oils and petroleum-base hydraulic fluids.

The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn. **Circle 372**

Distance Meter

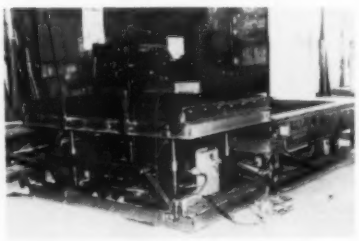
Type DM-100 distance meter provides constant readings accurate to ± 2 percent of full-scale deflection. The instrument operates in conjunction with noncontacting probes to provide a basically linear method of measuring distance from 50 microinches to ½ in.

A, E, C and F probes are available for ranges of 1, 10, 100 and 500 thousandths of an in. Measurements are directly read from a moving-coil meter. Length of the probe cable is 10 ft. A front panel outlet provides for connection to recorders or servo control systems.

Wayne Kerr Corp., 1633 Race St., Philadelphia 3, Pa. **Circle 373**

Sheet Feeding Table

A fixed height storage table at the rear of this two-section sheet feeding table has a fork truck or overhead crane which positions stacked sheet for stamping.



Rollers move the stacks to the front table at 20 fpm. The lift table, operated vertically by an electric foot switch, has a 10,000-lb capacity and can raise the load 16 in. in 40 sec.

Four crane hooks move separately or together. Stop blocks on the lift section prevent overtravel.

West Bend Equipment Corp., West Bend, Wis. **Circle 374**

Vibration Reducing Mounting Pads

Machinery from 50 to 220,000 lb. can be mounted with "Stanmount", a permanent resilient material which is oil and water resistant. Treated for indefinite use and reuse under machinery, the vibration and noise-control felt pads eliminate lag screws, bolts and foundation studs.

Adhesive recommended for use with the pads will bond equipment with a vertical pull or shear equal to a minimum of 90 lb. psi of mounting area.

The material is available in three densities, a variety of thicknesses, and in sheet lots or cut pad sizes. Vibration reduction is 85 percent.

Hillman Equipment Co., Sea Girt, N.J. **Circle 375**

Master Parallels

Master parallels provide an accurate, fast and easy means for setting internal measuring instruments.

Use entails assembly of the gage block combination required to obtain the desired instrument setting and wringing on of the master parallels (illustrated). Since no clamps or holders are needed, no external pressures are introduced to cause distortion and error.

Made of long-wearing carbide, the master parallels have a fine precision finish and gaging surfaces guaranteed for flatness to within 0.000003 in.

Ellstrom Standards Div., Dearborn Gage Co., 22038 Beech St., Dearborn, Mich. **Circle 376**

Vertical Welder

Heavy steel sections up to 10 in. thick can be welded six times faster with this machine than with automatic submerged arc equipment. The unit's vertical welding technique is based on the electroslag welding principle.

The Vertomatic is adaptable to steel plate and forgings from 1½ to 10 in. thick where the material can be vertically positioned. Sections are welded continuously and in one pass, eliminating joint preparation and slag removal.

The machine can process joints such as butt welds, "T" joints, corner welds with inside fillet, and reinforcing surface welds.

Arcos Corp., 1500 S. 50th St., Philadelphia, Pa. **Circle 377**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Storage-Feeder Unit

Capacity of up to 12,000 parts is available in units designed to bank and/or feed in automatic parts handling installations. They maintain in-storage part orientation, first-in-first-out part sequence.

Floor or overhead suspension models have one to six storage decks which can handle one or more parts at the same time.

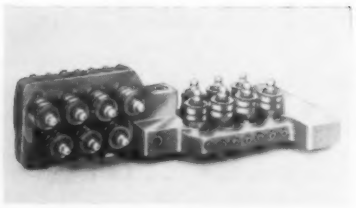
Input storage and output feed rate of the self-cleaning units is adjustable up to 6000 parts per hour. Unit enclosure and drip pan are optional.

F. Joseph Lamb Co., 5663 E. Nine Mile Rd., Detroit 34, Mich. **Circle 378**

Wire Straighteners

Adjustable rolls and needle bearings are features of units for straightening flat or round wire and wire with irregular cross sections. The straighteners have two sets of 5, 7, 9 or 11 grooved rolls set at right angles to remove material curvature on both planes. The rolls can be V grooved or grooved to exact diam.

Available in five standard and two



heavy duty models, the straighteners can be mounted on automatic slide, roll or hitch feeds.

Durant Tool Co., Providence, R.I.

Circle 379

Cast Alloy Tool Bits

Cobalt, chromium and tungsten are the main properties of the alloy used for tool bits having a high red-heat hardness substantially beyond temperatures at which high-speed steel tools break down. The hardness is lower than carbide but shock resistance of the bits is higher. They are corrosion resistant and have high transverse rupture strength.

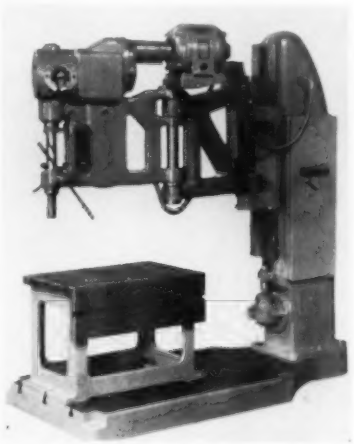
The bits can be run at cutting speeds 50 to 100 percent higher than high-speed steel and are used on both ferrous and nonferrous materials. They are available in ¼ through ¾ in. and in two styles of cut-off blades.

The DoAll Co., Des Plaines, Ill.

Circle 380

Radial Drilling Machine

Type G sensitive radial drilling machine is suited for drilling, tapping, reaming and similar operations on work such as machine repair, tool and die manufacture, and operations requiring a number of holes distributed over a large area. A jointed arm permits ready placement of the head. Time required to move from hole to hole is minimum.



The spindle is provided with hand feed and a six-speed drive. Vertical adjustment of the saddle is 24 in.; spindle travel, 7 in.; and the spindle can be moved in a radius of from 15 to 50 in. away from the saddle trunnions.

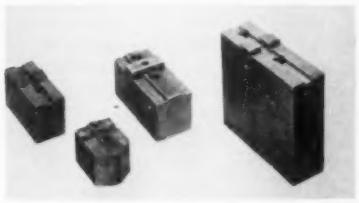
On a 60-cycle installation, spindle speeds are from 95 to 1140 rpm. Capacities are: 1⅛-in. drill, 1-in. tap in cast iron; 1-in. drill, ⅞-in. tap in steel. The machine is available for floor, post or wall mounting.

The Foote-Burt Co., Cleveland, Ohio.

Circle 381

Chuck Jaw Blanks

Precision machined of 1020 steel, an enlarged line of chuck jaw blanks fit over 300 master chucks and can be used on most machine chucks.



The soft blanks can be formed to hold irregularly shaped workpieces and can be machined to fit exacting holding requirements without marring work surfaces and without special face plates or fixtures.

Jergens Tool Specialty Co., 712 E. 163 St., Cleveland 10, Ohio. **Circle 382**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electrolytic Grinder

Model EG-10 electrolytic oscillating carbide tool grinder has a 12 x 29-in. table which can be tilted from 10 deg above to 22 deg below horizontal. Table-top is adjustable from 3 to 6 in. below the wheel centerline.

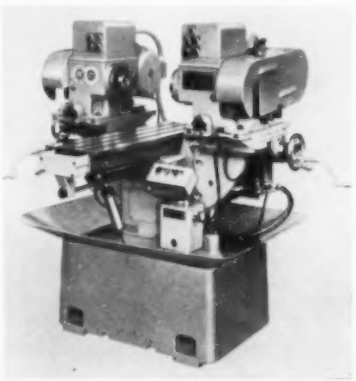
The oscillating spindle carries a 10-in. diam. wheel and has a variable stroke length of from 0 to 1½ in. Stroke frequency range is from 0 to 100 spm. Spindle speed is 2150 rpm.

Equipment furnished is as illustrated except for grinding wheel.

Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo, Mich. **Circle 383**

Milling Machine

Motors of two hp for both milling heads make it possible to handle heavy cuts over the 20-in. table feed range of this Twin Mill. The machine is equipped with a fail-safe electrical system which returns power feeds to starting positions if power fails.



The unit provides for independent six-way micrometer screw adjustment of both milling heads; automatic cutter retraction on table return stroke; double table cycling for rough and finish cuts at one setting; and push-button controlled automatic air hydraulic variable table feed cycle.

REM Sales, Inc., Box 41, West Hartford, Conn. **Circle 384**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Fluid Generates Protective Atmospheres

Decarburization and scale formation on carbon steels can be prevented by use of a carbon potential liquid which is automatically injected under pressure during the high heat phase of steel processing in luminous wall gas-fired furnaces.

The fluid supplies a supporting atmosphere which burns up excess oxygen and brings the products of combustion to a balanced state. It is used in the heat treatment of steels ranging in carbon content from 0.20 to 1.00. Each grade of fluid can be applied to a specific type of steel of given carbon content for any heating cycle.

A. F. Holden Co., 14321 Schaefer Hwy., Detroit 35, Mich. **Circle 385**

Nonferrous Welding Rod

Airco No. 21, a nickle-silver gas welding rod, is capable of joining 14 different metals. It can be used to replace many conventional bronze, steel and cast iron rods in production and maintenance torch applications where base metal can be heated to 1750 deg.

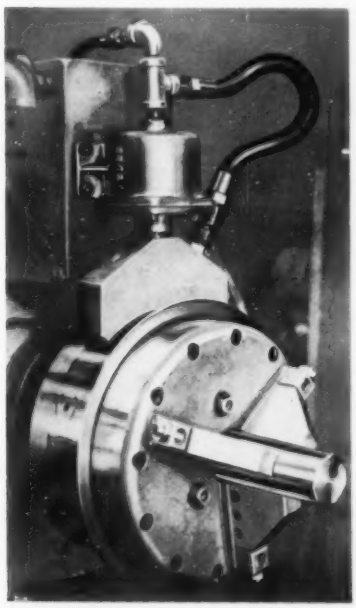
The rod can be used with mild, cold rolled, hot rolled, hot carbon, tool, cast and stainless steels; cast iron; Inconel; Monel; copper; copper nickels; bronze and malleable iron.

Rods are available in 36-in. lengths with diam of 1/16, 3/32, 1/8, 3/16 and 1/4 in.

Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N.Y. **Circle 386**

Air Coupling for Power Chucks

Manually operated snap coupling or power wrench are eliminated by use of retractable air coupling for power chucks with through-feed spindles. The device can be used with either automatically cycled or manually controlled bar feed machines. It facilitates machining shaft-like parts that project into the spindle and reduces cycle time for load and unload stages.



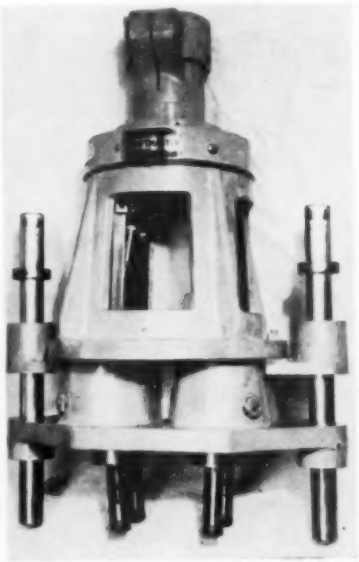
The valve system incorporated in the adapter plate permits interchange of air-operated devices without disturbing the control setup. The model illustrated is applicable only for devices operated on horizontal spindles.

N. A. Woodworth Co., 1300 E. Nine Mile Rd., Detroit 20, Mich. **Circle 387**

TOOLS of today

Adjustable Drillhead

Multiple spindle drilling or tapping of holes at an angle is done with this universal joint type adjustable drill-



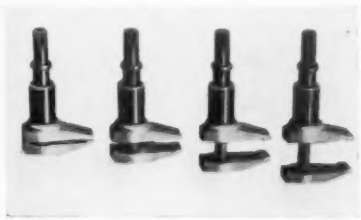
head with cartridge type spindle construction. Use of a different cartridge plate permits minor changes of the center distance or angle of the spindles.

Thriftmaster Products Corp., 1004B N. Plum St., Lancaster, Pa. **Circle 388**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Heavy Duty Clamp

Side grip fastener HDS 6 is adjustable for material thickness from 0 to 15/16 in. providing light, medium or



heavy spring pressure. Work is held with a 1 1/16-in. deep jaw throat or 3/8-in. deep jaw heel. The fastener can be used in place of many types of screw, "C", toggle or cam operated clamps.

Monogram Mfg. Co., 8557 Higuera St., Culver City, Calif. **Circle 389**

Generator Table

Automation demand has spurred development of an adjustable-speed, continuously moving turntable for induction heating generators. The unit's copper holder moving into the high

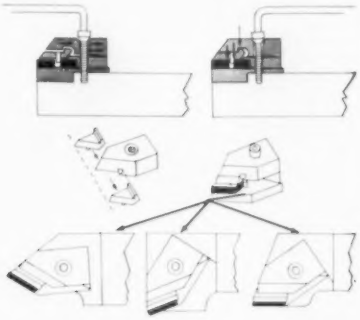
impedence field acts as a combination low impedence transformer secondary coil and as a work coil. There is no direct connection to the turntable for either RF current or cooling water.

Varied table diameters and numbers of stations are available for use with any of the company's generators, including 10 KW for soldering and brazing.

McDowell Electronics, Inc., 105 Forrest St., Metuchen, N.J. **Circle 390**

Carbide Toolholder

New tips and/or chip breakers can be inserted in these holders without disturbing machine setup. Triangular,



square or diamond shaped replaceable carbide tips are located automatically and accurately chucked in holder. Chip breakers are changed to accommodate various widths by automatic ejection as a new one slides into place.

Carbide Tool Co., 1306 Harper Ave., Detroit 14, Mich. **Circle 392**

Electronic Comparator

Elimination of electronic drift regardless of charges in the atmosphere or fluctuations in the line voltage is a feature of the Sensitron. The unit has a double capacitance gage head; stability within one millionth of an in.

throughout the operating day. Design of the stand controls the direction of thermal charge within 0.000004 in.

Amplifications are 50,000:1, 10,000:1 and 5000:1. Respective graduations are 0.000004 in., 0.0000020 in., and 0.000040 in. The range finder is linear over 60 divisions.

EAM Corp., 7 Williams St., Closter, N.J. **Circle 393**

Double Handle Torque Wrench

Less than ¾-in. rotary travel gives a total torque range of 100 in. lb, making this one-man tightening tool useful in confined spaces.

A dial-indicator type tool, Model DTF-100 torques both right and left. Length of the wrench is 20 in.; weight 3 lb. Dial range is ± 0 to 100 ft lb, with minimum graduation equal to 5 ft lb.

A heavy-duty tool, Model TDF-600, has a range of ± 0 to 600 lb.

Apco Mossberg Co., 1010 Lamb St., Attleboro, Mass. **Circle 391**

Mechanical Load Indicator

Press strain, misalignment, fatigue and processing load can be measured visibly and mechanically by this small unit, 7 x 5 x 2 in. The Dial-A-Load, which is welded or bolted to the press frame, has a direct reading dial calibrated in percent of rated load. The self-contained unit requires no electronics or electrical circuit. Readings

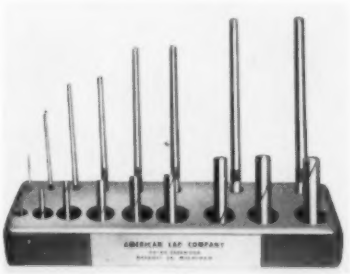
are obtained from microscopic dimensional changes in the press frame, amplified and converted into rotary motion to actuate the dial indicator.

Applications include press-fit assembly machines, hydraulic presses, rubber molding presses and other slow performance equipment.

Lebow Associates, Inc., 14857 W. Eleven Mile Rd., Oak Park 37, Mich. **Circle 394**

Expansion Laps, Arbors

Nine internal helical-slot expansion laps and eight corresponding arbors are available in a set with benchtop



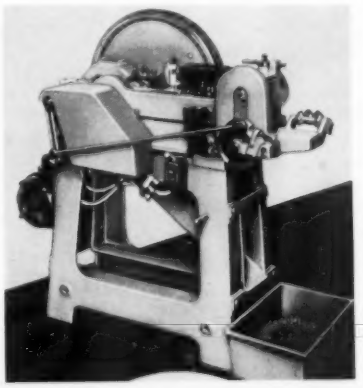
holder. Diameters of the laps range from 1/8 to 5/8 in. in increments of 16ths.

The holder has individual retaining sockets for each tool and arbor.

American Lap Co., 20180 Sherwood, Detroit 34, Mich. **Circle 395**

Cold Heading Machine

Mass production of long thin pins, lead wires and similar electronics parts can be accomplished with the Special



"O" cold header. The machine can handle wire from 0.020 to 0.090-in. diam and produce headed parts to 2 3/8 in. in length at a rate of from 60 to 100 pieces per minute.

REM Sales Co., West Hartford 7, Conn. **Circle 396**

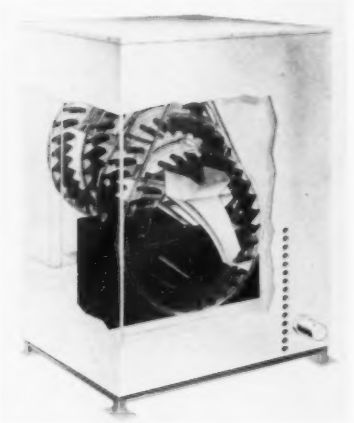
Preservative Paint

Metallic preservative finish provides better conduction in the electrolytic process for the grinding of single-point carbide tools. A gold-tone finish is used for steel cutting grade tools and silver-tone for nonferrous grades.

Super Tool Co., Detroit, Mich. **Circle 397**

Metal-Cleaning Unit

Metal parts enter this ultrasonic cleaning machine directly from automatic grinders, screw machines, blanking presses and other metal parts fabricating devices as well as from vibratory hopper feeds.



The four steps of the AutoSonex cycle are are immersion of parts in degreasing solution, rinsing, draining, and drying in an isolated chamber before discharge.

Flexibility in selection of solvents, water detergents or acids makes the unit adaptable to many cleaning operations. The cold solvent ultrasonic process removes oils, drawing lubricants, smut, chips, polishing abrasives and dust. Moderate rust proofing is optional.

Metalclean Equipment Co., Bala Cynwyd, Pa. **Circle 398**

Aluminum Valves

Three and four-way valves in the "Rotoram" line have a reciprocating and rotating motion during actuation, providing fast, smooth control of air cylinder applications. "Block V" packing permits free movement of the stem, yet maintains tight sealing to eliminate air leakage.

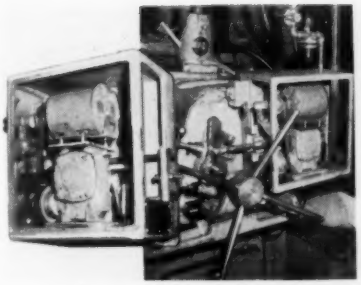
Made for ⅛, ¼, ⅜ and ½-in. pipe sizes, the valves are designed for operating pressure to 200 psi. Port entry is from either left or right side. Valves can be easily changed to other styles without basic dismantling.

Air-Mite Devices, Inc., 4401 W. Kinzie St., Chicago, Ill. **Circle 399**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Infeed Grinding Attachment

Variable feed rate at 12 to 40 pieces per min., depending on tolerance and finish desired, is offered with this "Lo-Die" centerless grinder infeed attachment. A controlled grinding and dwell cycle removes stock and holds finish constant.



The infeed is driven by a ¼ hp, 200 v, 3-phase motor. Parts are air-ejected after grinding.

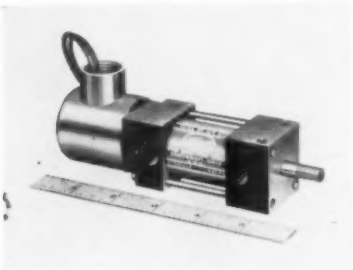
Lordstown Tool and Die Co., Inc., Warren, Ohio. **Circle 400**

Clamp Type Cylinder

Specifications of the CLA series Valve-N-Hed solenoid operated cylinder include 1⅛-in. bore, 150 psi air, 250 psi oil or water. The unit is immediately available in one, two and three-in. strokes, with others on special order.

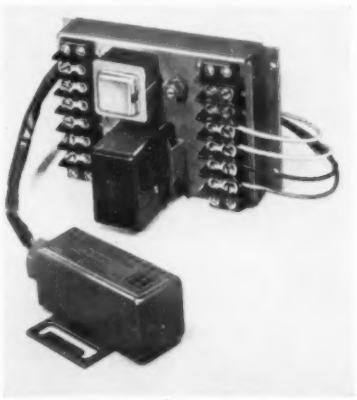
The cylinder is powered by a 115 v 60 cycle continuous duty operation on temperatures up to 180 F. Grommet type or ½ N.P.T. conduit electrical outlets are available.

The Sheffer Corp., 326 W. Wyoming Ave., Cincinnati 15, Ohio. **Circle 401**



Proximity Switch

Designed for use as a limit, interlock, counter or indicator sensor in unfavorable conditions created by oil, grit, extreme vibration, dirt or sludge, this switch consists of a sensor and separate transistorized amplifier with plug-in relay. Magnetic material is detected without physical contact. The two components may be located up to 150 ft apart without use of shielded wire.



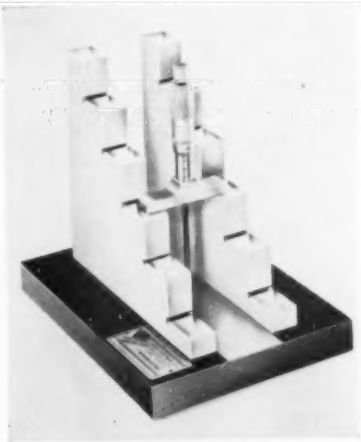
Adjustable sensitivity range is ⅛ to ½ in. Power requirement is 115 v 60 cycle.

Micro Switch, Minneapolis-Honeywell Regulator Co., Freeport, Ill. **Circle 402**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Depth Micrometer

Accuracy at depth mike setting, proper seating and adjustment of rods, and elimination of scrap caused by improper measurements are controlled by use of the Depth-Mikemaster.

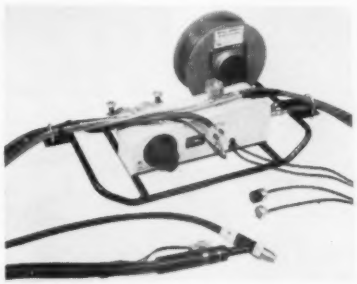


Accuracy of the instrument is 0.00001 on each step; range is 0.500 to 5.500 in. in six steps. Gage blocks added to steps determine lead-screw accuracy of micrometer and check mike to different sizes.

Size Control Co., 2500 W. Washington Blvd., Chicago, Ill. **Circle 403**

Arc Welding Products

The WC-1 welding control with wire drive and the AM-1 arc welding torch can be used with direct current in Dual Shield or other semi-automatic welding

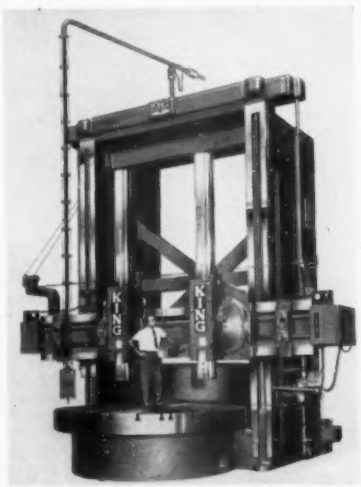


processes. Both are designed for use of shielding gases such as argon, helium or carbon dioxide in making horizontal fillets and flat position welds.

National Cylinder Gas Div., Chemetron Corp., 840 N. Michigan Ave., Chicago 11, Ill. **Circle 404**

Vertical Boring Mill

Custom built to user requirements, this 144-in. "Electrol" vertical boring and turning machine has full electrical control, increased height (188 in.) under rail, double ball-bearing track and extra-heavy-duty rail and rail heads.

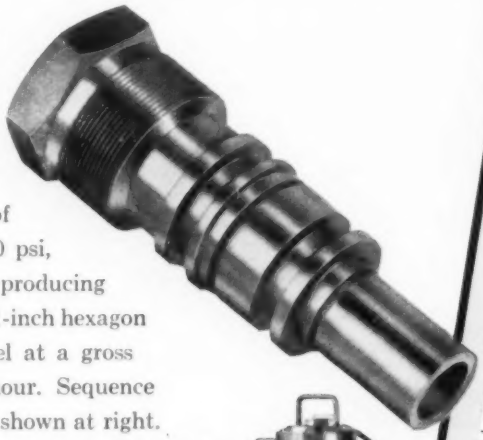


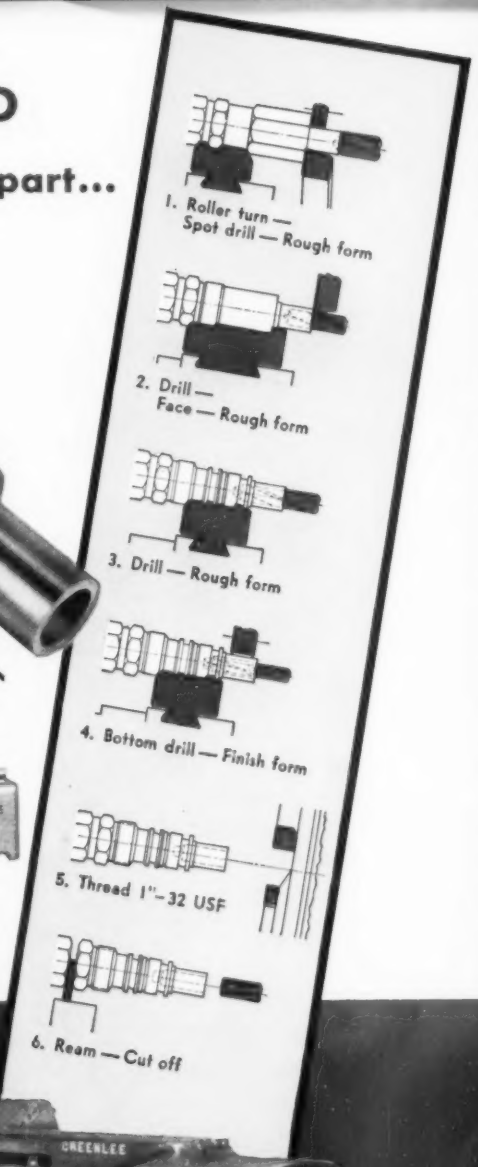
Automatic feed stops, Ultra-Matic programming, automatic tracing control of heads, and power indexing of turrets are optional. Sizes from 30 to 144 in. and up are available.

American Steel Foundries, 1150-Z Tennessee Ave., Cincinnati 29, Ohio. **Circle 405**

GREENLEE AUTOMATICS SPEED PRODUCTION of precision pump part...

The part is the injector cylinder of the Greenlee No. 798 High-Pressure Portable Power Pump manufactured by Greenlee Tool Co., a division of Greenlee Bros. & Co. Since the pump is capable of developing pressures up to 10,000 psi, extreme precision is required in producing the cylinder. It is machined from 1-inch hexagon 4150 chromium-molybdenum steel at a gross production rate of 48 pieces per hour. Sequence of the 13 operations performed is shown at right. Your Greenlee representative will be glad to help solve your precision part problems . . . just send us a print.





PRODUCTION MACHINERY
GREENLEE

Transfer Machines • Special Machines • Automatic Bar Machines
Die Casting Machines and Trim Presses • Woodworking Machines
Tools for Woodworking • Hydraulic Tools for Craftsmen

MMT=PE

GREENLEE BROS. & CO.

1879 MASON AVE.
ROCKFORD,
ILLINOIS

Use THESE HANDY FORMS

to obtain more FREE

INFORMATION

about Products covered

in this issue of

The TOOL ENGINEER

Circle KEY NUMBER —each item carries a Key Number.

Print clearly your name, title, firm name, product manufactured and your address.

NO POSTAGE REQUIRED

Copies of Technical Articles are available upon written request —as long as the supply lasts.

FIRST CLASS
PERMIT NO. 10782
DETROIT, MICH.

BUSINESS REPLY MAIL
No postage stamp necessary if mailed in the United States.

The TOOL ENGINEER

10700 Puritan Avenue

Detroit 38, Michigan

March 1960 *For More FREE* **INFORMATION** *Circle Number*

Name..... Title.....

Company..... Product.....

Address.....

City..... Zone..... State.....

A-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113
114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189
190	191	192	193	194	195	196	197	198	199	200								
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319
320	321	322	323	324	325	326	327	328	329	330	331	332						
350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368
369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387
388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406
407	408	409	410	411	412	413	414	415	416	417	418	708	709	710	711	712	713	714

INSIDE FRONT COVER INSIDE BACK COVER BACK COVER

Where more than one catalog or product is featured, indicate the key number and product information preferred: Key No. ..... Product.....

Use THESE HANDY FORMS

to obtain more FREE

INFORMATION

about Products covered

in this issue of

The TOOL ENGINEER

March 1960 *For More FREE* **INFORMATION** *Circle Number*

Name..... Title.....

Company..... Product.....

Address.....

City..... Zone..... State.....

A-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113
114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189
190	191	192	193	194	195	196	197	198	199	200								
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	999	999	999
000	000	000	000	000	000	000	444	444	444	444	555	555	555	666	666	317	318	319
320	321	322	323	324	325	326	327	328	329	330	331	332						
350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368
369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387
388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406
407	408	409	410	411	412	413	414	415	416	417	418							

INSIDE FRONT COVER INSIDE BACK COVER BACK COVER

Where more than one catalog or product is featured, indicate the key number and product information preferred: Key No. ..... Product.....

Circle KEY NUMBER —each item carries a Key Number.

Print clearly your name, title, firm name, product manufactured and your address.

NO POSTAGE REQUIRED

FIRST CLASS
PERMIT NO. 10782
DETROIT, MICH.

BUSINESS REPLY MAIL
No postage stamp necessary if mailed in the United States.

The TOOL ENGINEER

10700 Puritan Avenue

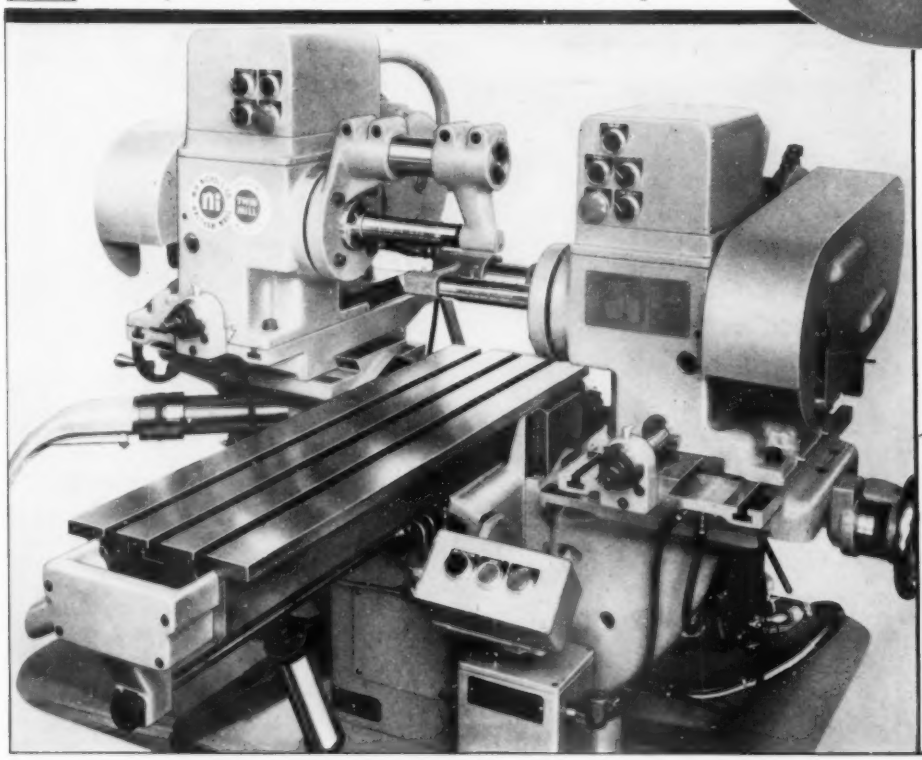
Detroit 38, Michigan

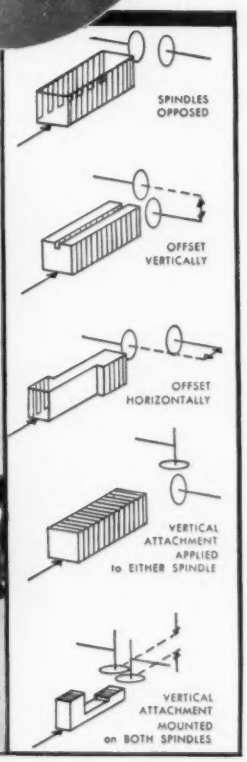
Copies of Technical Articles are available upon written request —as long as the supply lasts.

NOW MORE POWER MORE RANGE

NICHOLS TWIN MILL

PLUS Unequalled Versatility and Accuracy

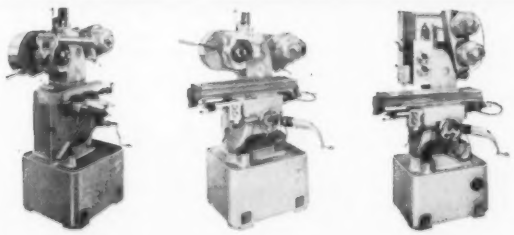




Now, the versatile Nichols Twin Mill is available with wider, heavier 36" table for greater work capacity, and 2 HP motor drive to each milling head for greater cutting capacity. Along with increased range and power the Twin Mill is equipped with a fail-safe electrical system which automatically returns all the power feeds to their starting positions in the event of a power failure

Twin Mill features that have built its reputation:

- Unique **six-way** adjustability of each milling head for fast set-up
- Automatic cutter retraction on table return stroke
- Double table cycling allows rough and finish cuts at one set-up
- Push-button controlled automatic air-hydraulic variable table feed cycle
- Automatic lubrication of table ways
- Fifteen speeds from 50 to 2050 RPM — suitable for all materials
- Vertical Heads for either or both horizontal spindles



Write for details on the complete Nichols line, "The Millers that Use Their Heads"
Sound, color, 35mm. movie "The Millers that Use Their Heads" available on free loan basis.

MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors **REM SALES INC.**

subsidiary of The Robert E. Morris Company

5006 FARMINGTON AVENUE • WEST HARTFORD 7, CONN.

Tap Extension

Type 707 tap extension has an overall length of 5 in., holds tap sizes No. 0 through ½ in., and is helpful in difficult or awkward machine tapping applications of castings, forgings and dies.

Available in three series, the 707-C extensions have shanks turned down to a $\frac{3}{8}$-in. diam to fit collets or chucks of varied tapping devices. In the smaller series, 707-A and 707-B, the shank diam is $\frac{3}{8}$-in. or less.

Ritmar Corp., 183 New York Ave., Huntington, N.Y. **Circle 408**

Plastic Adhesive

Adhering to most metals, yet with a nonmetallic base, a plastic adhesive is nonconductive and not affected by corrosive chemicals.

Bond-Seal is intended for watertight and oiltight repairs on metals and other materials when nonconductivity and resistance to acids and alkalies is needed.

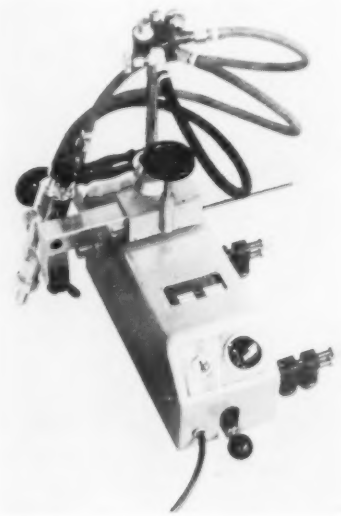
Specifically developed for use in electronic applications where adhesives containing metallic fillers are not acceptable, the product shows high adhesive qualities with iron, steel, aluminum, wood, glass, concrete, epoxy and polyester laminates. With steel, it has tested up to 3000 lb. in tensile shear. It will not adhere to plastics like vinyl, polyethylene or polystyrene.

Beetle Plastics of Crompton & Knowles, Fall River, Mass. **Circle 409**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Torch-Type Cutter

Adjustable for straight or beveled cuts, this 35½-lb machine is adjustable for straight or beveled cuts at any angle in iron plate from $\frac{1}{8}$ to 4 in. thick.



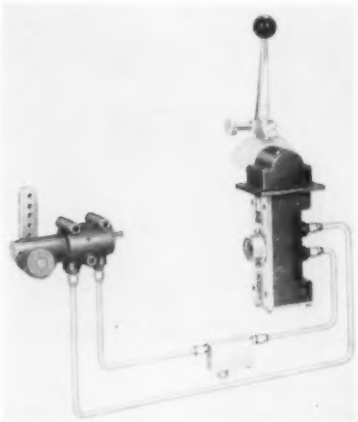
Speed is variable from 8 to 40 yd per hr in forward or reverse movement. The burner is adjustable sideways and upward and can be set at an angle by scale control.

Normally acetylene-operated, the torch can be used with hydrogen, propane, illuminating and other gases.

Milo Mfg. Co., 259 N. Broad St., Elizabeth, N.J. **Circle 410**

Vernier Lock for Remote Controls

Manually operated, a remote control system is a hydraulic linkage for accurately positioning, controlling and duplicating distant movement. Applications include control of valves, clutches, brakes, throttles, transmissions, feed mechanisms and engines on test stands.

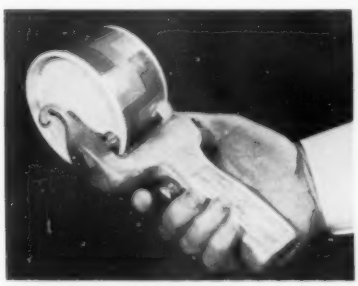


The vernier lock secures the master unit lever. Vernier adjustment permits lever travel of ± 5 deg.

Hydronic Corp., 12685 Arnold, Detroit 39, Mich. **Circle 412**

Plastic-Laminating Gun

Premixed Epoxy resin formulations and bases in the vicosity range from 50 to 30,000 centipoises can be sprayed with this gun, which is fed from disposable cardboard cups. Available in two sizes, the cups will hold ½ to 2 lb



of premixed resin. The nozzle, available in several openings, can also be used to spray liquid parting compounds.

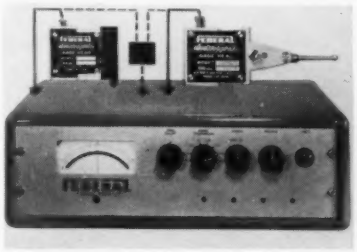
The 1½-lb gun operates at air pressure of from 50 to 60 lb.

U. S. Gypsum Co., 300 W. Adams St., Chicago 6, Ill. **Circle 413**

Gaging, Classifying Unit

Model 230 M-27 has eight ranges from ± 0.020 to ± 0.0001 in., four size control limits and five sorting categories. Electro-Probe gage heads with lever type or pantograph-mounted contacts are furnished with the unit. Several gage head combinations can be used.

The unit can be supplied in a cabinet or separately for mounting in a 19-in. rack. It is available without the classifier for laboratory or bench use.



Federal Products Corp., Providence 1, R. I. **Circle 414**

Tungsten Carbide Balls

Thirty-two standard sizes of tungsten carbide balls are available from stock, with other sizes on special order. The balls are AFBMA Grade 25, 0.000,025

sphericity, ± 0.0001-in. basic size tolerance, and 0.000,050-in. uniformity per container. Surface finish is 1 microinch.

Applications include valve elements, indicator points and bearings at temperatures to 800 deg.

Industrial Tectonics, Inc., Ann Arbor, Mich. **Circle 415**

Finishing Machine

Designed for high production finishing of small parts such as sparkplugs and vacuum tube leads, this wet blast unit is operable from a sitting position.

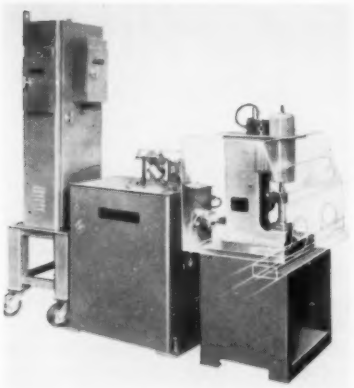
Work is loaded and unloaded at two bays in the operating station. Air-driven, moving blast guns are positioned at each bay. Blast guns are activated by depression of a foot lever. A pre-set timer regulates blast time and speed of gun oscillation.

Positioning devices are provided for special finishing applications and guns are individually movable.

Pressure Blast Mfg. Co., Inc., Manchester, Conn. **Circle 416**

Magnetic Force Welder

Specifically made to fit easily into standard dry boxes, the C-type magnetic force welding gun is designed for welding semiconductors and other small electronic parts under controlled atmosphere conditions.

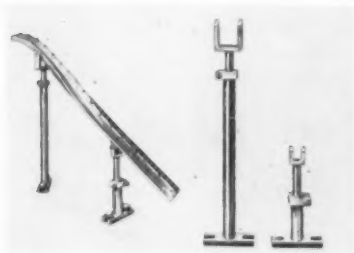


One of the company's several models develops 2200 lb weld pressure and accommodates transistor assemblies with a ring projection diam up to 1.250 in.

Precision Welder and Flexopress Corp., Cincinnati, Ohio. **Circle 417**

Chute Support Columns, Yokes

Used to support gravity feed chutes between the parts feeder and processing machinery, these prefabricated support columns are available in many sizes. They are classified for use with specific parts feeder models or can be used within limitations of each unit's dimensions.



Yokes can be rotated 360 deg and are furnished uniformed, allowing for modification by bending, cutting or welding to meet requirements of the support area.

Syntron Co., Homer City, Pa. **Circle 418**

ENGINEERING BOOKSHELF

WORK MEASUREMENT—*by Virgil H. Rotroff. Published by the Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. Price $4.85. 203 pages.*

Since work is a commodity, bought and sold like butter, it must be measured. From this very practical viewpoint, Mr. Rotroff develops his presentation of work measurement. The cost of work is important in product cost; the time required for work is important in production scheduling. For these and other reasons, work measurement is important to tool and manufacturing engineers, and this short book provides an easy introduction to the subject.

MANUAL OF INSTRUCTION FOR DIE DESIGN—*by A. A. Vezzani. Published by the American Society of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit, Mich. Price ASTME members, $4.50; nonmembers, $5.50. 210 pages.*

Books intended for instruction of die design are often too complicated to be intelligible or too simplified to be useful. Prof. Vezzani has successfully steered a middle course by compiling a book of actual design problems and directing it to men already initiated into shop practice, drafting and basic mathematics.

Starting with five problems relating to simple blanking dies, the author moves easily into the more difficult compound, forming and combination dies. Progressive dies are treated in three lessons beginning with a simplified pierce and cutoff operation. The third lesson in the set has the student designing a six-station progressive die with cam-forming action. No break in the development of progressive theory occurs but it develops fast enough to weed out the indifferent student.

Chapters on special dies for cylindrical forming and curling introduce the student to the "exotic" operations possible in pressworking. Other chapters on trim dies, cam dies, and simple and complex draw dies complete the list of conventional press operations.

All chapters of the book follow a basic outline beginning with an assignment of work to be performed and information to be acquired. Specifications of the die to be designed are itemized followed by basic theory of the operation involved. Steps included in actually designing the die then follow in numerical sequence.

Although no text can transform students into professional designers, this sequential method of learning design, if followed to the conclusion of the text, will provide an excellent technical background for those considering die design as a career.

PRACTICAL DESIGN OF SHEET METALS STAMPINGS—*by Federico Strasser. Published by Chilton Co., 5605 Chestnut St., Philadelphia 39, Pa. Price $10. 175 pages.*

With the aid of 555 illustrations the author presents in this book, basic processes, details of stamping design and special problems in metal stampings. The material for the book has been taken from the author's practical experience supplemented by other sources. The book should serve as a helpful reference for designers and an aid to solve or avoid many design problems.

Technology Monographs, Historical Series

A series of well-bound attractive paperbacks which should be of historical interest to tool engineers. The series is planned to provide the scholarly foundation essential for writing a History of Tools. Copies may be obtained from the Technology Press, Massachusetts Institute of Technology, Cambridge 39, Mass.

Number One, HISTORY OF THE GEAR-CUTTING MACHINE—*by Robert S. Woodbury. Price $3.00. 135 pages.*

The multilinear historical development of gear-cutting machinery is well-researched and well written, with many fine illustrations. The convergence of abstract mathematics and empirical gear-cutting experience led to the development of the sophisticated gear-cutting techniques we use today.

Number Two, HISTORY OF THE GRINDING MACHINE—*by Robert S. Woodbury. Price $3.50. 191 pages.*

From the polished artifacts of prehistoric times Mr. Woodbury traces the development of methods, abrasives, and the machine tools which interdependently contributed to the advanced grinding techniques used today. Many fine illustrations.

technical SHORTS

Seamless tantalum tubing in lengths up to 60 ft has been produced by Calumet & Hecla, Inc.'s Wolverine Tube Div. Tantalum has long been used in chemical process equipment because of its resistance to corrosion by acids. First major user of the new long-length tubing will be the Institute for Atomic Research of Iowa State University, Ames, Ia.

Long-Length Seamless Tubing Produced

Seamless tubing, previously available in short lengths, has had limited applications in the process industries which often require tubing in lengths of 30 to 40 ft. Manufactured by extruding a solid piece of metal through a die, the new longer lengths are possible because of recent advances in extrusion technology.

* * *

A new system of shorthand symbols representing machine parts has been developed to reduce the cost of producing three dimensional exploded views for service manuals. Invented by Joseph Spielvogel, an engineer and Naval Academy graduate, the system enables a draftsman to sketch all parts of complex machinery in a fraction of the time required for rough drawings. The shorthand notes can then be translated into conventional drawings showing the parts and the order in which they are assembled.

Shorthand Drawing Symbols Developed

* * *

An adhesive system, designated as PA-746, has been developed for bonding Teflon to itself and other materials. Manufactured by Plastic Associates, Laguna Beach, Calif., the new system is supplied in kit form for both laboratory and production line applications. Each kit includes an agent used to prepare the Teflon surface as well as a

New System For Bonding Plastics

two-part bonding agent. Previous adhesive systems have been applicable only to grades of Teflon which were specially treated. Such treatment often had a deleterious effect on electrical and physical properties because of the carbonization process used. Because the new process is applied only to the surfaces which are to be bonded, no adverse physical affects result.

• • •

Improved Aluminizing Process

An improved furnace-bond aluminizing process has been developed for high-temperature service applications by Stainless Processing Div., Wall Colmonoy Corp., of Detroit. Recommended for application on any Series 400 stainless steels, all carbon steels and a variety of alloy steels, the process may also be used on austenitic stainless steels.

In operation, the process utilizes mechanical spray equipment to apply an aluminum coating cold. The coating is then furnace-bonded to the base metal at high temperatures.

Advantages of the furnace-bond process are improved abilities to resist oxidation, corrosion, abrasion and erosion, as well as a superior diffused-alloy bond. Total coating buildup is held within a tight range of 0.002 to 0.005 inch.

• • •

Data System Controls Quality

A completely transistorized data acquisition system for improving quality control in tinplate manufacture has been developed by General Electric Co. First installation of the system was at the Aliquippa, Pa., plant of Jones and Laughlin Steel Corp., where it is used to determine the grade and record the defects in tinplate coils.

With the tinplate line operating at speeds up to 2000 fpm, a data accumulator records information from a footage meter, strip thickness X-ray gage, pin-hole detector, top and bottom coating thickness gages as well as a visual inspection station. Upon completion of a coil, all data is correlated and summarized automatically. This information is then fed into an electric typewriter and card punch to provide permanent records for visual inspection and computer analysis.

Trade Literature

for free booklets and catalogs—use request card, page 171

High-Heat Steels

"Cr-Mo-V Steel for Service at Elevated Temperatures" discusses current thought on the resistance of steels to graphitization while exposed to extended operation at elevated temperatures, as well as creep strength and stress-rupture strength values. Chemical composition and strength values are detailed; test reports from various parts of the world are summarized.

Vanadium Corp. of America. **Circle 301**

Aircraft Spec Chart

A comprehensive chart of aircraft tubing specifications, designed in the shape of a file folder, contains information including applications, specifications, physical and chemical properties.

Tube Distributors Co., Inc. **Circle 302**

Industrial Catalog

Descriptive information about Aeroquip hose, fittings, self-sealing couplings and related products is contained in catalog No. 204. Included are specifications concerning the company's products for use on general industrial applications such as plant machinery, mobile equipment, oil field machinery and stationary power plants. A hose selector chart is included, listing the various applications and fluids for which specific hose types are recommended.

Aeroquip Corp. **Circle 303**

Die Protection

Practical ways for protecting expensive machine tool dies with precision switches are described in a series of five sheets. Data sheet No. 1 describes how a switch is used to detect misfeed of material in a progressive die. No. 2 shows how to prevent die smash-up due to a faulty pressure pad. "Pile-up of parts can't occur to injure this progress die" is the title of No. 3. No. 4 tells how to eliminate pilot pin breakage in slide-fed dies. No. 5 details how one switch can insure fast, safe operation of a two-position die.

Micro Switch, Freeport, Ill. **Circle 304**

Weld Fasteners

Dimensional information on stock weld nuts, weld screws, special purpose weld parts and leg levelers is covered in a catalog which includes welding information, electrode data and designs and weld setups for welding individual parts plus illustrations and descriptions of typical applications.

The 50-page book also contains an engineering section with detailed explanations of how to achieve optimum welds under various conditions and tips on how to cut costs and boost the number of welds per hour through good welding practices.

The Ohio Nut & Bolt Co. **Circle 305**

Welding, Cutting Torches

Gas welding and cutting hand torches, outfits, tips and accessories are covered in a 36-page illustrated catalog. Also included are specification charts on the company's welding and cutting tips for both general purpose and special gas welding and cutting.

Air Reduction Co., Inc. **Circle 306**

Blast Cleaning Barrels

Directed to manufacturers of small to medium-size castings, forgings or heat treated parts, molders of plastic forms, and reconditioners of brake shoes and other auto parts, Bulletin No. 706 describes features of the standard duty line of Rotoblast cleaning barrels from 1½ to 18 cu ft capacity.

In addition to photographs and cutaway diagrams, the 16-page bulletin gives dimensions and specifications of each of the five barrels described, showing how each can be tailored to individual requirements. A section is devoted to industrial case histories.

Pangborn Corp. **Circle 307**

Stainless Steel Gage Blocks

Outstanding features of the company's recently announced stainless steel gage blocks are discussed in a data sheet which includes full information about available sets, grades and prices.

The DoAll Co. **Circle 308**

Tellurium Copper

A technical data sheet discusses physical, mechanical and fabrication properties of tellurium copper. Primary use of the alloy is in rod form for screw machine work where high heat and electrical conductivity are required. Other uses are connector parts in electrical switches, transformers, wire connectors, circuit breakers, and simple screws and rivets carrying electric current.

Bridgeport Brass Co. **Circle 309**

Two-Way Valves

An eight-page bulletin, No. 910022, describes in detail the line of Series 20, two-way valves for air, oil, water, gas or chemical. Contents include specifications, ordering information, outstanding features and dimensions.

Airmatic Valve, Inc. **Circle 310**

Maintenance, Safety Catalog

Fifteen different products to aid safety directors and maintenance engineers in planning and executing industrial maintenance and safety identification programs is covered in a 36-page, illustrated catalog.

Included are proper marking of piping systems, identification of plant wiring and electrical equipment, correct lubrication of machinery, and marking of hazardous plant areas and equipment.

W. H. Brady Co. **Circle 311**

Arc Welding Electrodes

New products and new engineering data have been added to this edition of Electrode Pocket Guide. The 64-page booklet contains information on all types of electrodes available from Airco.

Under each electrode listed, a brief description is given together with applications, procedures and pertinent A.W.S.-A.S.T.M. data. Two eight-page foldouts contain charts of recommended electrodes for welding A.S.T.M. and trade name steels, and comparison tables for mild steel and hardfacing electrodes of leading manufacturers.

Air Reduction Co., Inc. **Circle 312**

Trade Literature

Roller Bearings, Pillow Blocks

High capacity spherical roller bearings are described in detail in a 52-page book, No. 2760. The illustrated book covers all design features, including comprehensive selection data and formulae, shaft bearing seat diameters, lubrication information, shaft details and bearing load ratings, diagrams, photographs and charts.

Link-Belt Co. **Circle 313**

Drill Bushings

Printed on durable card stock, a drill bushing catalog folds out for easy reference and type comparison. Tables are color-coded, prices are listed and quantity discounts are shown.

Drill bushings in the following types are listed: American Standard and A. S. A. Standard in both ground and unground OD, American Thinwall, Tungsten Carbide and Superwear-X bushings—plus a line designed for plastic tooling, including the Ceram-A-Grip and American Redskin bushings.

American Drill Bushing Co. **Circle 314**

Proximity Switch

Preliminary Data Sheet No. 163 is a four-page publication of technical information on a new proximity switch. Included are photographs, dimension drawings, and descriptive diagrams of sensitivity range, sensitivity envelopes, mounting requirements, and wiring instructions. Information on operating and electrical characteristics is also included.

Micro Switch Div., Minneapolis-Honeywell Regulator Co. **Circle 315**

Press Brakes

Enlarged, modernized line of Series N press brakes, 90 through 1500 tons, is presented in the 28-page Bulletin 89E. Description and illustration of design features, special work area provisions, typical forming and bending dies, tables for computing bending, punching, and blanking tonnages, die space and filler block dimensions, and comprehensive specifications are included.

Niagara Machine & Tool Works. **Circle 316**

Boring Bars

Bulletin B-1259 describes all available standard boring bars, including micro-adjustable interchangeable head, micro-adjustable and nonadjustable types. All bars use square or triangular throw-away carbide inserts. Complete engineering and specification data are included on the five different styles of bars.

Wesson Co. **Circle 317**

Drive Selection

Bulletin No. 9102 contains 36 pages of information on the company's Ultra-V drive. It includes drive selection tables for stock and nonstock sheaves, horsepower tables, nomograms for service-level comparisons of drive costs, sheave and belt specifications, bushing and keyseat specifications, installations instructions for "Sure-Grip" sheaves, and information on how to check the tension of an Ultra-V drive.

T. B. Wood's Sons Co. **Circle 318**

Rigid Dynamics

"A Simplified Treatment of Rigid Dynamics" by L. Ivan Epstein has been issued as the quarterly technical bulletin of Lowell Technological Institute.

The author, assistant professor in LTI's department of physics and mathematics, deals with his subject in two phases: a visualization of the physical significance of the products of inertia, and an elementary proof of the existence and mutual perpendicularity of the principal axes.

Lowell Technological Institute. **Circle 319**

Multipliers, Trig Tables

Common engineering units of one system can be quickly and easily converted into related units of other systems with a pocket-size, 74-page booklet. Contents are alphabetically arranged with complete cross reference. The booklet contains 44 pages of trigonometry tables.

Carr Lane Mfg. Co. **Circle 320**

Blast Cleaning

Factors to be considered in the selection of steel blast cleaning abrasives are outlined in a 20-page illustrated booklet. Metallurgical developments applied in the production of steel shot are described, a section is devoted to methods of quality control, and a list of user's testing results is included.

Pangborn Corp. **Circle 321**

Abrasive Finishing

This new data sheet contains recommendations for finishing carbon and stainless steels. Satin, butler and bright finishes are described. Information includes abrasive compound recommendations, wheel speeds and types of buffs. A section covers blending and simulating mill finishes on stainless steel for blending in weld marks and for the removal of tool and die marks.

The Lea Manufacturing Co. **Circle 322**

Leak Testing

Bulletin GET-2936, gives detailed instructions on use of halogen leak detectors for finding leaks in enclosures that can be pressurized. Applications discussed include aircraft and missile fuel and hydraulic systems, steam boilers, valves, piping, transformers, and air-conditioning and refrigeration equipment.

The six-page bulletin discusses system preparation, testing procedures, quantitative measurement techniques, and calibration.

General Electric Co. **Circle 323**

Industrial Diamonds

"Benefits to Purchasers of Industrial Diamonds" describes the customer-oriented approach of the division and outlines several facets of its program for industrial diamond purchasers.

Discussed from the diamond purchaser's viewpoint are availability, reduced investment requirements, the full line product offering, customer service technical assistance, sales development and market development capabilities, and the overall organizational setup to provide purchasing convenience.

Engelhard Industries, Inc. **Circle 324**

Trade Literature

Tracer Control Systems

Hydraulic tracer control systems for 1, 2 and 3 dimensional applications on machine tools are described in bulletin No. SB-2. Other systems, including the Synchro-Trace automatic programmed 3-D duplicating system, are also covered.

Lathe tracer attachments, applications and components are illustrated and described.

True-Trace Corp. **Circle 325**

Band Machines

High-tool-velocity band machines are described and illustrated in an eight-page catalog. Applications, design details, specifications and attachments of the Zephyr machines are included.

The DoAll Co. **Circle 326**

Heavy Duty Lathe

Booklet No. 213 covers the company's Model HD 2516 heavy duty lathe. Engineering details and specifications are given with a point-by-point discussion of new features.

Nebel Machine Tool Corp. **Circle 327**

Grinding Wheels

Booklet PG-358 describes features of the company's mounted grinding wheels and contains a complete wall chart showing all standard shapes and sizes. The chart can be detached and hung on the wall for reference. The booklet also contains a table of recommended starting grades for various jobs and suggestions for selection of mounted point wheel grades.

Cincinnati Milling Products Div., Cincinnati Milling Machine Co. **Circle 328**

Microfilming Manual

Details of how the Air Materiel Command of the U. S. Air Force has converted engineering drawings and data to microfilm mounted in aperture cards, has been reprinted in an eight-page, illustrated manual titled, "Standardization That Works."

The Filmsort Co., Div. of Minnesota Mining and Manufacturing Co. **Circle 329**

Tableting Equipment

Described and illustrated in general catalog AC-61 are a broad line of machines for tableting pharmaceuticals, chemical catalysts, food products, paints, electronic disks, ferrite cores, powdered metal parts and plastics.

Other equipment covered includes drying ovens, coating stands, mixers, granulators, tablet dusters, hard capsule banders and fillers, tablet counters and power triturate machines.

Arthur Colton Co. **Circle 330**

Motor Reducers

Catalog MR-58 deals with vertical and in-line motor reducers for use with equipment such as blowers, compressors, conveyors, cranes, hoists, elevators, machine tools, rotary mills, mixers and stokers.

The 28-page selection guide describes construction and mechanical features of reducers in eight housing sizes for applications up to 125 hp and output speeds of 9 to 420 rpm.

Philadelphia Gear Corp. **Circle 331**

Air Gages

Complete specifications and price information on an expanded line of precision air gaging instruments, elements, and related accessory equipment is presented in a 16-page, illustrated catalog.

Featured are single and multiple column air gaging instruments equipped with a new "Multi-Amp" tube which permits conversion from one amplification to another by changing calibrated scales.

Air Gage Div., Dearborn Gage Co. **Circle 332**

Field Notes

Holmes A. Whitmore, Executive Vice President of **Jones & Lamson Machine Co.**, has disclosed the development of a new leasing arrangement for users of machine tools. Speaking at the Savoy Hilton Hotel in New York City, Whitmore predicted that the metalworking industries will turn to machine tool leasing on a large scale because of critical shortages of after-tax capital.

Under the new J. & L. program, known as the Profitivity Lease Plan(R), the lessee commits himself to lease one or more pieces of equipment for a specific period. At the end of that period he can renew his lease at greatly reduced rates but at no time does the equipment become his property.

The plan is expected to be attractive to smaller industrial users who often have insufficient capital to replace equipment or wish to divert capital into other areas.

new facilities

Formal ground-breaking ceremonies have been held at the site of the new **Superior Hone Corp.** plant. Scheduled for completion in April, the plant will have approximately 50 employees.

Timken France, a division of Timken Roller Bearing Co., is expanding its plant in Colmar, France, by construction of a shipping center. To be erected at a cost of $300,000, the center will be built as an extension of an existing building.

Detroit Gray Iron and Steel Foundries, Inc., has announced completion of plans for construction of its new **Shaw Process Division.** The Detroit firm will manufacture precision iron and steel castings under a licensing agreement with Shaw Process Division of British Industries Corp. Production in the new division will begin in 1960.

Filon Plastics Corp. has opened a new $2,000,000 plant for manufacture of fiberglass reinforced plastic building panels. Approximately 200 persons will be employed.

Plans for construction of a new research center have been revealed by the **American Brass Co.**, Waterbury, Conn. The center will include metallurgical and chemical laboratories as well as equipment for experimental production of new products. Scheduled for completion in 1961 the research center will be built at a cost of $1,500,000.

Associated Testing Laboratories, Inc., a manufacturer of environmental test equipment, will occupy a new building in Wayne, N.J., early this year. The facility, designed for the company's specialized testing and manufacturing operations, will cost approximately $500,000.

expansions

Pioneer Aluminum, Inc., a distributor of aircraft extrusions in the west has announced plans for a $1,000,000 construction program. Included in the program are a new plant, warehouse and office building, all of which will be located adjacent to the parent company, Morris P. Kirk & Son. Occupancy of the facility is tentatively scheduled for June 30, 1960.

Gibson Caribe, Inc., a subsidiary of Gibson Electric Co. of Delmont, Pa. has broken ground for a new plant in Lugvillo, Puerto Rico. Located 30 miles from San Juan, the facility will be among the first to produce electrical components in Puerto Rico.

acquisitions

Lockheed Aircraft Corp. has acquired a substantial interest in Aeronautica Macchi, S.A. of Italy. The transaction provides Lockheed with a strong base in the European Common Market in which Italy is a member nation. Stock ownership in Macchi will be held by Lockheed Aircraft International.

U. S. Systems, Inc., has announced acquisition of all the capital stock of Modern Die and Tool Corp., a California concern with assets in excess of $1,000,000. H. C. Smith, a director of U. S. Systems, has been named president of the newly acquired company.

Hamilton Standard, a division of United Aircraft, has completed negotiations leading to purchase of a 50 percent interest in Microtecnica, Inc. of Turin, Italy. Products of the Italian firm include a wide variety of navigation and testing instruments. Plant facilities will be adapted to manufacture of many of the parent firm's products for the European Common Market.

moves

All facilities of Airborne Instruments Laboratories, a division of Cutler-Hammer, Inc., have been moved to Deer Park and Melville, L.I., N.Y.

Combined Los Angeles sales offices of both the Durez Plastics Div. and Western Chemical Div. of **Hooker Chemical Corp.** have been relocated at 6277 East Slauson Ave., Los Angeles 2, Calif.

Nu-Matic Grinders, Inc., has moved its headquarters and manufacturing operation from 8224 Carnegie Ave. to 875 East 140th St. in Cleveland, Ohio.

L. S. Starrett Co. has relocated its New York Branch to an integrated sales office and warehouse at 48 Commerce St., Springfield, N. J. Another branch opened recently by Starrett is located at 4949 West Harrison St., Chicago.

new companies

Ultrasonic Industries, Inc., has been formed by Paul Martin Platzman, a New York industrialist and leading authority in the field of ultrasonics. The new company, now in temporary quarters at Albertson, L.I., has signed a lease-purchase agreement for acquisition of property in Engineer's Hill Section of Plainview Industrial Park. Plans call for construction of a 36,000-sq ft building on this site in 1960.

Austin Co., international engineering and construction firm with headquarters in Cleveland, has established a new company in Buenos Aires. Designed to handle the parent company's activities in Argentina, the subsidiary is currently engaged in expansion programs of the South American divisions of Ford Motor Co. and Chrysler Corp.

Kollsman Instrument Corp., New York, a wholly owned subsidiary of Standard Coil Products, Inc., has formed a West German subsidiary. The new company, Kollsman Luftfahrt Instruments G. m. b. H., has obtained space at Munich Airport for production and engineering activity. Kollsman is a factor in the aircraft and guided missile programs of West Germany.

Field Notes

Bivans Conveyor Co., a company specializing in design, fabrication and installation of industrial conveyors has been formed in Los Angeles. The new company is affiliated with Bivans Corp., a manufacturer of cartoning and carton conveying machinery. The new company will handle all details of conveyor manufacture from design to installation.

awards

Sir George Edwards, Managing Director of Vickers-Armstrongs (Aircraft) Ltd., will be the 1959 recipient of the **Daniel Guggenheim Medal.** The Medal, sponsored jointly by The American Society of Mechanical Engineers, Society of Automotive Engineers and Institute of the Aeronautical Sciences is awarded annually for notable achievements in the advancement of Aeronautics. Sir George Edwards is internationally known as a designer and administrator in the aircraft industry.

The Buckendale Award, a major award of the Society of Automotive Engineers has been presented to George J. Huebner, executive engineer-research of Chrysler Corp. Presentation of the Award followed Huebner's lecture "Computer-based Selection of Balanced-life Automotive Gears" at the annual meeting of the SAE in Detroit.

association news

Five companies elected to membership in the **National Screw Machine Products Association** include: Wains Screw Products, Ltd., Burlington, Ontario; Freeman Mfg., Milwaukie, Ore.; B & T Bimatic Mfg. Co., Portland, Ore.; Fasco Screw and Machine Co., Philadelphia; and Fasteners, Inc., East Boston, Mass. NSMPA is the trade association for more than 270 producers of screw machine products.

Grants to education comprised nearly 70 per cent of the $96,638 in contributions made during the past year by the **Maytag Company Foundation, Inc.,** according to the non-profit organization's annual report issued today by Robert E. Vance, foundation president. Vance, also vice-president and secretary of the Maytag company, reported that education grants accounted for $66,724 with the remaining contributions directed to various research, health and welfare, youth and other groups.

The largest single allocation, $42,159, was for the Foundation's college scholarship program, which included grants

to 73 students and to the 28 colleges and universities they attend. Other major educational grants were made to the Iowa College Foundation, National Fund for Medical Education, United Negro College fund, Council for Basic Education and the Old Gold Development fund for a special project at the University of Iowa. Ten special scholarships again were awarded to engineering and commerce students at midwestern universities.

Special courses in nuclear energy have been given to 433 engineering and science teachers as well as 50 instructors from technical institutes in jointly sponsored summer programs of the **American Society for Engineering Education** and the Atomic Energy Commission. These programs have been offered for the past four years and will be offered again in 1960 according to an announcement by W. Leighton Collins, Secretary of ASEE.

new activities

Houghton Laboratories has changed its name to **Hysol Corp.** The Olean, N.Y. firm, founded in 1949, was among the first in its field to offer commercial lines of epoxy adhesives and electrical insulation products to American Industry.

Hupp Corp. has acquired the assets of John J. Fannon Co. and John J. Fannon Products Co. of Detroit. The acquisitions will operate as wholly owned subsidiaries of Hupp Corp. Financial details of the transaction were not disclosed.

Smico Sales Co., Minneapolis based industrial sales firm, has been appointed sales representative for Torit Mfg. Co., St. Paul, manufacturers of industrial dust collecting equipment. Smico will handle sales and application engineering for Torit units and systems in Minnesota and other north-central states, with special emphasis on dust collecting applications for the milling industry.

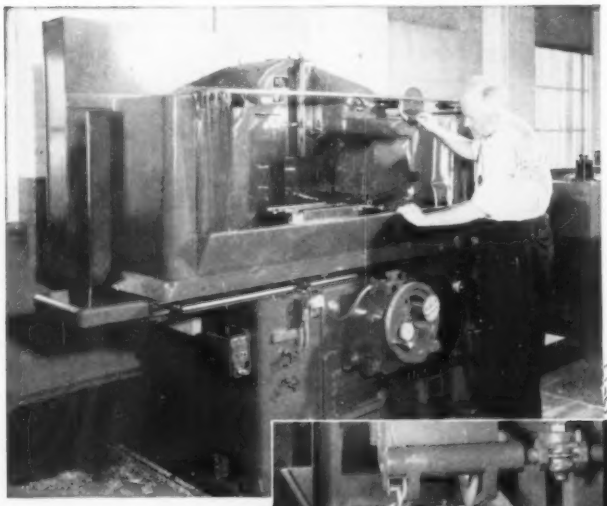
Appointment of **Hope Rubber Co., Inc.,** as a distributor for Crown compressed air line units has been announced by Parker Hannifin Corp., of Cleveland. Hope Rubber Co. has warehouse operations in Massachusetts and Connecticut. The Crown line, manufactured by the Hannifin Division in Des Plaines, Ill., includes air pressure regulators, air filters and lubricators.

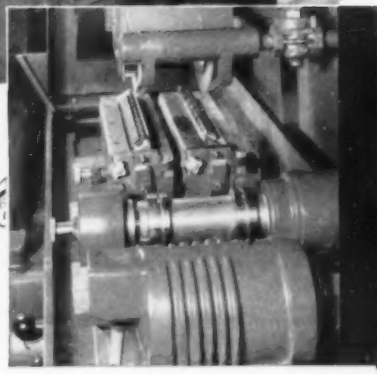
The American Behler Corp., 28 Harbor Street, Stamford, Conn., has announced the appointment of new regional representatives throughout the country to sell and service Bechler Swiss Automatic Bar Machines and auxiliary products. The entire line of Bechler Swiss Automatics will be available through each representative, with factory trained technicians to install new machines and service existing ones.

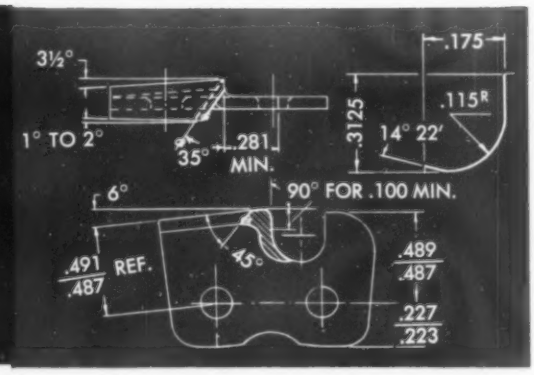
Lor Mac Associates, a sales engineering group operating throughout the state of Michigan, has been appointed Michigan sales representative for Fusion Engineering of Cleveland, Ohio, a factor in the field of automation soldering and silver brazing. The appointment is one of several territories to be filled in a sales expansion program by Fusion Engineering.

Tatnall Measuring Systems Div. and the Nuclear Systems Div. of **The Budd Co.** have been merged into a single entity to be known as the Instruments Division. The merger has been effected to eliminate overlapping sales and management functions of the divisions.

Thompson — TRUFORMING CUTS COSTS 60%







For 140 years, the policy of The Draper Corporation of Hopedale, Mass., has been to offer the highest quality product at the least possible cost.

Following this policy, its subsidiary, BlueJet Corporation, manufacturers of the famous BlueJet saw chain, installed a Thompson Truforming grinder to grind the cutting edges on their chain saw routers. These routers were formerly ground, piece by piece, by a force of 8 employees.

The Thompson Truforming operation is now cutting former grinding costs by 60%. 3 men only are now required for the operation. 40 L.H. and 40 R.H. routers are now ground simultaneously with one pass of the crush formed wheel, resulting in a day's production of over 12,000 pieces—many times that produced by the former method. Both the uniformity and sharpness of the routers have been greatly improved.

For 25 years, Thompson has pioneered and developed the modern advances in crush form grinding. If you have a time-saving, product-improving or cost-cutting problem in your operations, it will pay you to investigate the work Thompson Truforming grinders are now doing in plants all over the country. Our engineering experience is available to you without obligation. Write for Catalog T558.

"Keep Thompson in mind for the daily grind"

THE THOMPSON GRINDER COMPANY

SPRINGFIELD, OHIO

Thompson SURFACE GRINDERS

The board of directors of the Hercules Motors Corp. has elected Adolph A. Karrasch, left, vice president in charge of manufacturing. Karrasch, who joined the company in 1959 as director of manufacturing, will also supervise purchasing. Prior to joining Hercules, Karrasch served for 22 years with the International Harvester Co. in five of its plants.

Kenneth G. Farrar, right, has been named vice president in charge of manufacturing for the Douglas Aircraft Co. He became general manager of the company's Long Beach division in 1953 and a vice president of the company in 1954. Farrar came to Douglas in 1934 as a jig and fixture builder. He succeeds Frederic W. Conant who recently retired.

Men at Work

ELMER E. BRAUN, formerly manager of ferrous metals operations, has been named works manager, Central Foundry Div., General Motors Corp. He will be responsible for both ferrous and nonferrous metals operations in the division's five plants.

WILLIAM M. HARKNESS has assumed the newly created post of plants engineer for Norton Co.'s Santa Clara, Calif., plant. He joined the company in 1942 and has worked as a detailer, draftsman, layout engineer and supervisor of project engineering for the Refractories Div., Worcester, Mass.

Three managerial appointments in the General Electric Co.'s Computer Dept. have been announced. KENNETH R. GEISER, former manager of engineering, was named manager of the department's newly organized business-planning operation; DR. ROBERT R. JOHNSON, former manager of the department's Computer Laboratory at Palo Alto, Calif., was named manager of engineering; and DR. HELMUT M. SASSENFELD, former manager of operation for the department's Huntsville, Ala., Computer Center, was appointed manager of the newly formed applications section.

Appointment of DR. JOHN G. HUTTON as general manager of General Electric's Specialty Control Dept., Waynesboro, Va., has been announced. A native of Sunderland, England, Hutton received his B.S. degree from Durham University, and his masters degree and doctorate from Yale University. He joined G. E. in 1942 and, prior to his recent appointment, was manager of electrical engineering at the company's Schnectady laboratory.

Borg-Warner Corp. has announced appointment of WILLIAM F. MARTIN as director of manufacturing services. After 14 years with General Motors, Martin went to Borg-Warner's Byron Jackson Div. in 1956 as manufacturing manager. Prior to his recent appointment, he served as vice president in charge of manufacturing.

Detroit Controls Div., American-Standard, has elevated three executives to vice president. They include JOHN R. WARNOCK, general manager of marketing; RICHARD L. CAMPBELL, director of engineering; and GEORGE F. BUTTERFIELD, general manager of manufacturing. The three will continue to supervise these activities.

CHARLES E. DRURY, formerly manager of the Danville, Ill., plant, Central Foundry Div., General Motors Corp., has been named to the division's newly created post of divisional director of reliability. Drury has been with the company since 1949. THOMAS E. SMITH succeeds Drury as Danville plant manager and DALE W. WONUS is plant production manager.

JOHN F. CLAYDON, general manager of the Coated Abrasive Div. of The Carborundum Co., was recently elected vice president of the company. He joined Carborundum in 1935 as an experimental engineer, became an industrial salesman, a manager of the Detroit sales district, sales manager and, in 1957, was appointed general manager of the Coated Abrasives Div.

NORBERT J. PALMER has been appointed chief engineer of Monogram Precision Industries, Inc., Wickland Mfg. Div. Prior to joining Wickland, he was chief engineer at American Electronics. He has also served as plant manager, Western Design & Mfg. Corp.; chief manufacturing engineer, G. M. Giannini & Co., Inc.; and chief production engineer, Ampex Corp.

H. E. Blaine, left, has been appointed production control superintendent of Western Brass strip operations at the East Alton, Ill., plant of Olin Mathieson Chemical Corp., Metals Div. Since joining the company in 1956, Blaine has served as industrial engineer at East Alton and, recently, as chief industrial engineer of the division's brass plant at New Haven.

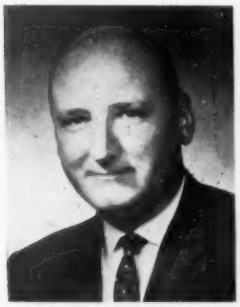
Appointment of Louis S. Oosten, right, as vice president in charge of engineering, the Bell & Gossett Co., has been announced. Oosten joined the company in 1934 as a machine operator, was named to the engineering staff in 1935, and from 1942 to 1953 was assistant to the chief engineer. From 1953 until his new appointment, he served as plant superintendent.

Men at Work

Announcement has been made of the appointment of ALBERT J. REICHERS to the position of general plant manager for the Cooper Alloy Corp. Since joining the company in 1946, Reichers has served as general foreman, plant superintendent and plant manager of two of the company's divisions.

Announcement has been made of the appointment of William W. Sorn, left, to the position of manager of manufacturing for the Lipe-Rollway Corp. of Syracuse, N.Y. A licensed professional engineer and past president of the Syracuse Management Club, Sorn has spent 15 years in manufacturing management and supervision with the Carrier Corp. and the Murray Corp.

William Leibowitz, left, has been appointed manager of the Woodside, N.Y., plant of Accurate Specialties Co., Inc. Recently plant manager of the Metalart Corp., Leibowitz has spent 16 years in the manufacture of metal components. In his new position, Leibowitz will be responsible for expanded production of the company's line of alloy preforms clad metal components.



George P. Burns, right, has been elected vice president and sales manager-machine tools for the Van Norman Machine Co. Burns, who joined the company 20 years ago as a turret lathe operator, worked as plant foreman, general foreman and assistant superintendent. He later became service manager, division manager and, most recently, sales manager-machine tools.

William M. Shutt, Jr., right, has been named divisional master mechanic of the Saginaw Steering Gear Div., General Motors Corp. Since joining the company as an assistant toolroom foreman in 1941, Shutt has served as an assistant chief tool engineer, production engineer, a chief designer, and as chief tool engineer. He succeeds Walter A. Wegner who is on leave of absence.

FRANK B. JEWETT, JR., formerly executive vice president, has been elected president of Vitro Corporation of America. He succeeds J. CARLTON WARD, JR., who has been named chairman of the board of directors for the company. CHARLES S. PAYSON, retiring board chairman, has been elected to the new office of chairman of the board's executive committee.

Men at Work

Election of JOHN J. MCDONALD and LINDEN G. CRIDDLE as vice presidents of Consolidated Systems Corp., a wholly owned subsidiary of Consolidated Electrodynamics Corp., has been announced. McDonald will continue as director of engineering and Criddle as director of operations.

Promotions in the Curtis Machine Div. of The Carborundum Co. include; RICHARD D. RUTT, production manager; PAUL W. JOY, manager of the technical branch; ADOLPH C. CARLSON, manager of the machine design department; WILLIAM C. KEYES, senior design engineer; and FRANCIS M. OWREY senior quality control engineer.

VERNON L. HAAG has been appointed director of manufacturing for the Electro Tec Corp. He had been vice president and general manager of the Farnsworth Electronics Co., a division of I. T. & T. since 1957 and previously was vice president and director of the Gray Mfg. Co., Hartford, Conn.

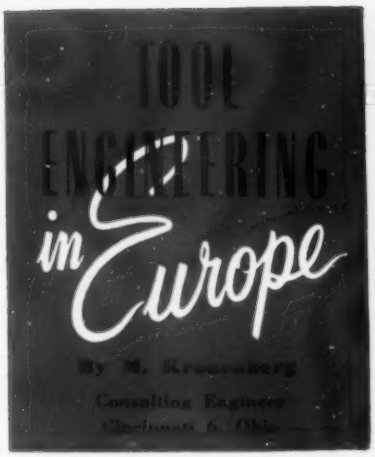
Several executive position changes have been announced by DeVlieg Machine Co., Royal Oak, Mich. C. B. DEVLIEG, formerly company president, has been named chairman of the board of director. C. R. DEVLIEG, formerly executive vice president, has been named president. RICHARD A. JERUE, who was chief engineer, is now vice president-engineering, and ALLEN N. SWEENEY, chief engineer of the Microbore Div., has been named director of engineering and research for the company.

John J. Owen, right, has been elected executive vice president and director of the Millers Falls Co. Since 1940 Owen has served in electrical tool engineering, as assistant plant superintendent, acting advertising manager, assistant to the executive vice president and, since 1959, as a vice president. He will supervise production, engineering and sales.

Harold B. Schott, right, has been named assistant to the president-sales—a newly created position at the Brown & Sharpe Mfg. Co. He will be primarily responsible for tightening of central coordination in the company's divisional sales efforts. Succeeding Schott as general sales manager, industrial products division, is Joseph E. Kochhan.

The recently created Executive Group of Micrometals Mfg. Co. includes MARION E. ABBOTT, owner; FRITZ A. ZANDER, general manager; FRANK W. KABAT, sales manager; WILLIAM E. PENGELLY, office manager; CHARLES H. GOOD, plant manager; and DONALD PARKES, chief engineer.

ADOLPH R. SCHAUB has been named manufacturing manager of the L. J. Wing Mfg. Co., Linden, N.J., a division of Aero Supply Mfg. Co., Inc. He came to Wing from M. W. Kellogg.



Ceramic Cutting Tools

A summary of experiences with ceramic tools is found in an article by E. Klinger in *Industrielle Organisation*, Vol. 28, No. 9, 1959, p. 269-276 under the title "Oxyd-Keramische Schneidwerkzeuge."

Starting with a list of manufacturers in the United States, England, Russia, Czechoslovakia, Sweden, France, Italy, East Germany and West Germany the author shows comparisons of the microstructure of various types of ceramic tools, excluding "cermets"—which belong in the class of modified carbide tools. Physical property data are included in the article in order to demonstrate the differences between steel, carbides and ceramic tools. While carbides are heavier than steel, ceramics weigh only half as much as steel. Thermal conductivity of ceramics is considerably less than that of carbides and steel. On the other hand, thermal expansion of ceramics is somewhat higher than that of carbides.

The author discusses the negative and positive aspects of ceramic tools and presents suggestions for improving the negative aspects, recommending higher speeds, less feed and considerably less depth of cut. Vibration-proof machining conditions are important. A clamped-on toolholder with adjustable chip breaker and a wire attachment is shown.

Tool cost taken from actual workshop examples are listed per 100 pieces machined comparing ceramics with carbides. The reduction is very considerable such as from 72 to 17 cents (Chromium-steel) or from $2.40 to 33 cents (brake ring, cast iron 220 Brinell) or from $11.90 to $2.20 (locomotive wheels). Tool geometry is discussed, as is the problem of a built-up edge occurring when machining aluminum and titanium.

Tool Engineering in Europe

Double Rake Angle

Every tool engineer is familiar with the recommendation to "dull" cutting edges—particularly in the case of carbide tools—by stoning them at about 45 degrees across the edge. In this way tool wear is often reduced and tool life improved.

There has been, however, no special information available as to the size of the land that should be stoned across the edge. Very often following the common recommendation does not improve cutting conditions but makes them worse. An article dealing with the size of the land producing a negative rake angle but leaving the positive rake angle intact is, therefore, of unusual interest. The article is by M. E. Mueller-Zuerich and appears in *Werkstatts Technik*, Vol. 49, No. 11, 1959, p. 653. The title is "Die Wahl der Zweckmaessigen Fasenbreite an Drehwerkzengen."

The author has investigated the effect of various sizes of the negative rake land on cutting forces, cratering of the tool face, chip compression and on the wear land on the tool flank. He concludes that the negative rake land should be less than twice the amount of stock to be removed. This latter quantity closely corresponds to twice the feed per revolution in turning.

The author also recommends reducing the positive rake and omitting a negative land on tools where the strength of the cutting edge cannot be sufficiently increased by a negative land.

Introducing the ratio of width of land to feed per revolution he presents curves obtained from numerous tests showing a considerable increase in cutting force of 15 to 20 percent when the ratio exceeds the value 2. Minimum crater formation occurred when the ratio was 1.5 (20 percent crater reduction). Chip compression also showed an increase when the ratio exceeded 2. The chip flows only over the negative and in this case and the advantages of the negative land are lost.

Maintenance and Machine Design

An article by H. J. Meyer in *Werkstatts-Technik*, Vol. 49, No. 2, 1959, p. 676-680 deals with the troubles encountered by plant engineers in maintaining machine tools. The title of the Article is "Wuensche des Pflege-Ingenieurs and den Werkzeugmaschinen-Konstrukteur."

One section of the article is devoted to chip removal and protection from

Tool Engineering in Europe

dirt. Feed boxes are often so designed that chips can get into the teeth of the gears but can hardly be removed. Chips accumulating on the guideways of milling machines and the table cause damage and are also difficult to remove.

Flat guideways, the author says, are inexpensive to make but are collectors of dirt and chips, increasing the wear of the beds, which in turn makes frequent adjustment of gibs necessary. Methods of bolting the headstock to the bed are likewise discussed and three illustrations show good and poor designs from the standpoint of the maintenance engineer.

Felt strips attached to the carriage or other reciprocating members of a machine tool are useless. They retain chips and smear them over the bed. Allen-head screws are likewise considered by the author as places where dirt can easily collect unless they are covered.

Another section of the article deals with lubrication and hydraulics. Wear and electrical equipment are also covered.

Precision Machine Tools

Two types of precision machining are predominant in the mechanical-optical industries according to an article by F. Gruenwald in *Feingeraete Technik*, Vol. 8, No. 8, 1959, p. 345-350, under the title: "Wirtschaftlicher Einsatz von Feinstbearbeitungs Methoden."

One type serves decorative purposes, the other is directed towards obtaining accurate surfaces with small tolerances, satisfying high requirements in macrogeometrical shapes and microgeometrical surface finishes.

The metals used for decorative purposes are mainly light alloys and brass, their machining requires high cutting speeds of 1000 to 2000 fpm and spindle speeds between 3000 and 6000 rpm; thus great accuracy in the positioning of the main spindle is needed.

Diamond tools are frequently used for obtaining high accuracy. The author recommends a fairly large infeed of about 0.002 to 0.003 ipr. Precision surfaces can be obtained by turning, milling, drilling, rolling, broaching, grinding and lapping. Tests were made to compare these machining methods for accuracy in relation to cost.

It was found that with steel, brass, bronze and aluminum grinding operations could be carried out with a saving in time and cost of as much as 50 percent. The heavier cutting forces were more advantageous than lower forces and feeds. The author also discusses other machining methods.

who's meeting and where

Mar. 6-9. American Society of Mechanical Engineers. Gas Turbine Power and Hydraulic conference, Rice Hotel, Houston, Tex.

Mar. 7-8. Steel Founders' Society of America. Annual meeting, Drake Hotel, Chicago, Ill.

Mar. 9-11. Instrument Society of America. Temperature Measurement symposium, Deshler-Hilton Hotel, Columbus, Ohio.

Mar. 9-11. Office of Ordnance Research, U. S. Army, and School of Engineering, North Carolina State College. Ceramics conference, College campus, Raleigh, N.C. Information available from Dave Stansel, Box 5125, State College Station, Raleigh, N.C.

Mar. 16-17. American Welding Society, New Jersey Section. Welding educational seminar, Essex House, Newark, N. J. Information available from A.W.S., New Jersey Sect., P. O. Box 133, Bloomfield, N. J.

Mar. 28-30. Material Handling Institute, Inc. MHI, ALTA-PEM, ITA and Monorail meetings, Pittsburgh-Hilton-Hotel, Gateway Center, Pa.

Mar. 29-31. Illinois Institute of Technology, in cooperation with nine technical societies and fourteen educational institutions. American Power conference, Hotel Sherman, Chicago, Ill. Information available from R. A. Budenholzer, Mechanical Engineering Dept., Illinois Institute of Technology, 3300 Federal St., Chicago 16, Ill.

Apr. 3-8. 1960 Nuclear Congress and Atomic Exposition, New York Coliseum.

Apr. 18-19. ASME, IRE and AIEE. Third Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, Ohio. Additional information available from Publicity Chairman, Room 530, 1213 W. 3rd St., Cleveland 13, Ohio.

Tech Digests

What the Individual Can Do for Standardization

Hundreds of highly qualified people are available and are willing to evaluate your proposal for a new standard. Should the project actually get off the ground, men of technical and administrative competence will provide substantial support in bringing your proposal to final promulgation. What can the individual do for standardization?

1. The individual must first recognize the need for a standard.
2. He must be willing to undertake effective action after a technical appraisal of his problem.
3. He can offer his services or those of his personnel to a committee for the purpose of framing his proposal.

Ideas for standardization arise from:

1. The need for lower unit costs
2. Reduction of manufacturing and purchasing costs
3. The need for smaller inventories of part and tool components
4. The requirement for wider availability of supply
5. Broader product application

It has long been known in the medical profession that the specialist in a given area of practice generally realizes greater monetary returns than does the general practitioner. This is equally true in the engineering and related professions. The areas open to standardization are broad and deeply interesting, affording many opportunities for specialization. To any qualified person, standards specialization will provide a sound and active professional status. Also, contributions thereto can reap great personal satisfaction and substantial monetary reward. Executives who have such capable people on their staffs should encourage them in professional growth along these lines.

No one individual is solely responsible for the success or failure of any proposed standard. Standards proposals are acted upon by hundreds of qualified persons and, therefore, the responsibility is shared. The originator is not slighted, however, and there is satisfaction to be gained from the knowledge that a proposal, even if not finally accepted, has commanded the attention and professional services of qualified persons of national prominence. The concepts of other contributors that parallel those of the individual make clear to the new member that he is not "working in a vacuum." It is gratifying to see that your own observations and proposals are consistent with those reorganized. Another inducement is the pride of authorship of an accepted and published standard, which can be as great as the pride of the inventor or of one who has developed a manufacturing process.

Based on a paper by George J. McLaughlin, Grumman Aircraft Engineering Corp., presented at the 10th Annual Conference of American Standards Association, 70 East 45th St., New York 17, N. Y.

▼ ▼ ▼

The Deformation Process in Metal-Cutting

Examination of orthogonal machining of a strain-hardened material indicated that the strain imparted to the chip is a measure of the deviation from Merchants' original equation:

$$2\phi + \tau - \alpha = 90 \text{ deg}$$

provided the temperature increases are not so great as to alter the stress-strain curve drastically. Investigation further indicates that an accurate evaluation of τ in the foregoing equation requires an assessment of the forces rubbing on the tool flank.

Based on ASME Paper 59-A-165 by W. J. McDonald and B. F. Murphey, Minnesota Mining and Mfg. Co. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Properties of Asbestos Reinforced Laminates at Elevated Temperatures

When long fibered chrysoltile asbestos fibers are used as a reinforcement for heat resistant, phenolic or silicone resins, the composite must be molded at pressures above 200 psi for optimum properties. Structural laminates molded at pressures of 200 and 400 psi were evaluated in the laboratory to simulate three possible rocket conditions.

The phenolic and silicone asbestos specimens exposed to the first test, simulating rocket motor conditions of high temperature, erosion, and variation in the percentage of oxygen fared rather badly. The percentage of oxygen had no appreciable effect on the rate of degradation. The phenolic asbestos specimens showed considerably lower weight loss due to erosion than the silicone asbestos. However neither material was considered satisfactory in the present state for use in most rocket motor applications.

The second test which roughly simulated rocket nose cone conditions, again demonstrated a superiority of the phenolic asbestos over the silicone asbestos composite. Based upon depth of penetration of ablation and the amount of material ablated away, phenolic asbestos was considerably more resistant to ablation. This phenolic asbestos composite merits further review as a material for nose cones.

The third series of tests were concerned with the loss in weight and strength at temperatures of approximately 1000 F for periods up to 192 hours. In this environment silicone asbestos laminates maintain a high percentage of their mechanical properties up to 800 F. This silicone asbestos composite should be considered for further evaluation for rocket bodies or structural components that will be subjected to temperatures of 800 F range for relatively long periods of time.

Based on SAE Paper 106V by Norman E. Wahl, Cornell Aeronautical Lab., Inc. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Position and Rate Control of an Infeed Centerless Grinder

The Bel-Air infeed control system (Bellows Co.) is a control-method for infeeding centerless grinders that overcomes many of the problems encountered in production grinding. The end position of the slide can be repeated regardless of variations in input part-size, and parts can be ground to a tolerance approaching the machine's capability.

To accomplish this, Bel-Air Infeed Control System uses an electronic gage to determine the slide position. By continuously monitoring the slide, the stopping point at the end of the infeed cycle is made highly repeatable and feed rates are changed at predetermined switchover points. When these switchover positions are reached, a signal is sent to the translation mechanism that drives the slide at the preselected feed rates. The electronic gage can be considered the brain, and the translation mechanism can be considered the muscle of the system.

Based on a paper presented by P. Ohringer, Airborne Instruments Laboratory, at the AIEE 11th Annual Machine Tool Conference. American Institute Electrical Engineers, 33 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Reliability Design Criteria

Design criteria are the measures of a design and include the design environments, design strengths, and design factors which separate the applied environments from the strength capabilities. Designers manipulate estimated applied internal environments, estimated strength capabilities, and the environment-strength separation factors in a manner such that the design produced will be expected to perform satisfactorily. Environments and strengths are predicted from current and past tests. The environment-strength separation factors in the past have been selected by trial and error methods which have resulted in limiting the number of failures to a satisfactory level. However, there are more rational approaches to the selection of environment-strength separation factors.

The various aspects of design criteria include the concepts of environments, strengths, strength-environment separation factors, and the allocation of unreliability values to the elements of a system.

Based on SAE Paper No. 101V by J. M. Brown, H. L. Leve and P. H. White, Hughes Aircraft Co. Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

Analysis of Power Spinning of Cones

Sheet metal can be deformed in power spinning by bending, shearing or a combination of both. Forces required calculated from simplified deformation theory are the lowest among all the forces computed from the lengthy analysis using incremental theory. The effect of the variables on the tangential forces is observed as follows:

1. As the port radius gets bigger, the tangential force is decreased, but it will never get to a value less than that predicted by a simplified method
2. The tangential force is linearly proportional to the yield limit and the blank thickness
3. Increasing the feed will increase the tangential force
4. The larger the included angle of the cone, the smaller will be the force
5. As the roller round-off radius approaches zero, the efficiency approaches its best value; i.e., smallest force. As this radius gets bigger than about ¼ in. in practical conditions, a further increase does not affect the force appreciably
6. As the roller radius approaches zero, the force is least. When the roller radius ranges between 6 and 10 in. the tangential force changes very little.

Based on ASME Paper 59-A-173 by B. Avitzuv and C. T. Yang, University of Michigan. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

High-Quality Structural 17-4PH Castings

The presence of microshrinkage and large amounts of dendritic-shaped ferrite are the major causes of low ductility and the resultant rejection of 17-4PH castings. It has been found that retarding the cooling rate of the mold minimizes microshrinkage, reduces the ferrite content, and reshapes the ferrite into a globular and blocky form. It has long been known that microshrinkage can be reduced or eliminated by the use of proper gating methods. Extensive testing has indicated that closer chemistry control of 17-4PH has a profound effect upon the ferrite content. Since shotted material was found to have inadequate chemistry control for use in prime structural castings, the use of remelted bar stock was found to solve this problem. From the preceding comments, it is evident that 17-4PH is a

very sensitive alloy requiring close chemistry control and precise foundry techniques. To produce prime structural castings of high standards and consistent quality, constant control of foundry practices and heat treatment must be maintained.

Based on SAE Paper 104V by W. R. Roser and K. E. Kuschell, Norair Div. of Northrup Corp. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Rocket Motor-Gear Tooth Analysis—Hertzian Contact Stresses and Times

The Hertzian contact stress in gears is one indicator of the permissible load which a given set of teeth may carry safely. It is a factor used in determining score loads, pitting loads, and so on. Of course there are other factors of great importance, such as surface treatment, the lubricant used, the temperature involved, sliding velocity, and the like, but the contact stress serves as a definite indicator of permissible loads to be transmitted.

The Hertzian contact times are now becoming of importance also, since it has been observed that these contact times are of the same order of magnitude as the relaxation times of the lubricants. It has been observed also, that these thin oil films, such as are found in gear tooth mating, exhibit peculiar physical properties when loaded with extreme suddenness. These films are believed to act as elastic or plastic solids under these conditions, providing great protection for the tooth surfaces. It is for these reasons that an analysis of these stresses and contact times may be of value.

Based on ASME Paper 59-A-256 by Roy W. Prowell, U. S. Naval Postgraduate School. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Applications of Current Materials to Hot Airframe Design

Hot airframe structures may be designed which avoid the complexities of artificial cooling systems and attaching insulating materials for thermal protection. This is achieved by proper arrangement of suitable high-temperature materials, and minimizing thermal stresses where possible. The problems of sonic fatigue and panel flutter are difficult and, as of now, appear to be solvable only through adequate panel stiffness. Material cooling through radiation is a practical means of lowering structural temperatures, thus eliminating the speed-altitude regime in which commonly available materials may be employed. Thus, a high surface emissivity is considered desirable even though there are thermal gradient problems which it aggravates.

Rigid structures, as exemplified by wings and fuselages built of spars, ribs, frames and sandwich panels may be utilized where a proper excess of panel strength over the thermally induced stresses may be maintained. For very high-temperature vehicles, consideration should be given to thermally nonredundant structure.

Based on Paper 104U by M. B. Dunn, M. D. Musgrove and O. T. Ritchie, Boeing Airplane Co. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

Helixform Bevel and Hypoid Gears

The Helixform process is a recent development in the art of gear cutting. Gears made by this method are classified as nongenerated which means that the workpiece remains at rest while the teeth are being cut. Cutting the gear

without generation is a process especially adapted to high production and accurate machining and is the method used to manufacture most automotive spiral bevel and hypoid gears. Pinions which match nongenerated gears are of course produced with generating motion, that is, the tools cutting the teeth of the pinion are mounted on a machine element which, while the teeth are being cut, turns in concord with the turning of the pinion on its axis.

Based on ASME Paper No. 59-A-90, by G. M. Spear, C. B. King and M. L. Baxter, The Gleason Works. American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

▼ ▼ ▼

Improving Man's Workload in Space Vehicle Systems: Methodology and Measurement

A basic requirement of man's function in a biological environment must be provided that is compatible with his life and earthly being. Beyond this a procedure is suggested for realizing optimum work load of these substances. This procedure involves: (1) determination of the functions that must be performed by the system, (2) analysis of these functions in order to provide a realistic basis for allocation of functions to man or machine or among the crew members involved, (3) analysis of the tasks of the crew. On the basis of these analyses, contributions to design of equipment, definition of personnel requirements and definition of training requirements will be made. While this may appear a large order, it is pointed out that human factors specialists should be involved in the statement of any requirements that include man as a link in the system.

Based on ASME Paper 59-A-195 by A. J. Latham, Chance Vought Aircraft. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Standard as an Essential Engineering Service

Motivation for creation of industrial standards must be that of serving a particular activity, rather than saving it. Acceptance of this philosophy could do much to resolve our present standards problems. To begin the slow proc-

ess of developing a standard only after a practice has resulted in years of waste and confusion is an "after-the-fact" approach with a staggering cost. It wholly overlooks the degree to which effective industrial standardization and sound engineering are synonymous. Standards should be engineering objectives. As such, their very first effect is to render valuable engineering service. If there is a sound engineering approach to a practice, we simply cannot justify waste of a single man-hour in endlessly duplicating the engineering effort necessary to create the standard, any more than we can tolerate the cost of unsound engineering for that practice.

Based on a paper by Kenneth M. Stoll, Sylvania Equipment Development Div., presented at the 10th National Conference on Standards, American Standards Association, 70 East Forty-fifth St., New York 17, N. Y.

▼ ▼ ▼

Development of High-Temperature Thermocouple Materials

It appears feasible that improved high temperature thermoelectric alloys having a more desirable combination of properties can be developed. The ultimate temperature measurement capacity of alloys operating unprotected in an oxidizing atmosphere should be about 1800 C and consist of platinum metals containing minor alloying additions. Above this temperature it will be necessary to rely on the development of devices based on other principles such as microwave attenuation.

Based on SAE Paper 105V by R. C. Lever, General Electric Co. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

Some Problems of Press Forging Lead and Aluminum

Press-forging equations based simplified states of stress yield predictions of average forging pressures which are in substantial agreement with experimental data obtained with commercially pure lead and aluminum.

The local press-forging pressures as determined by pressure-sensing elements are in agreement with those predicted by theory for the lead and aluminum-disk experiments. For closed die-forging experiments the local pressures tend to equalize within the body of the forging. This is at variance with the theory but is readily explained by the readjustment of the pressures due to internal plastic flow.

The possible increase of forging pressures due to the extrusion of the flash through a restriction at its edge is substantial when compared with conventional processes; it appears to be a feasible forging process for the purpose of improving the impression ability in press forging.

Based on ASME Paper 59-A-164 by A. G. MacDonald, S. Kobayaski and E. G. Thomsen, University of California. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Integrated Cost Reduction

Integrated cost reduction may be defined quite simply and broadly as cost reduction through integrating human behavior with environment. Integrated cost reduction may be expressed in terms of integrating cost-reduction programs with the everyday actions of the people in a company.

A good cost reduction man is a man with many hats. Perhaps one more hat should be added to those commonly worn by him. That hat would be the hat of the psychologist.

Psychologists have a law that says "appreciation precedes execution." All that this means is that people must know *what* to do and *why* they are to do it before they can do anything effectively. In the realm of cost reduction,

then, the combination psychologist and cost reduction expert must translate cost reduction into meaningful terms for all who must execute his program . . . down to the lowest echelon floor sweeper. And he must communicate these meaningful expressions of cost reduction through all echelons. Thus he starts to integrate human behavior with environment.

To accomplish integrated cost reductions communication channels must be established:

- Bulletins
- Organization manuals
- Training programs
- Intraplant committees
- Conversation

Through these channels we establish:

- A Spirit of competition
- Confidence in leadership
- Knowledge of competition
- Soundness of strategy
- Meaningful motivation

All this sounds like a big order . . . a big job. Well, it is. But it is the key to successfully integrating cost reduction with human behavior.

Based on ASME Paper No. 59-SA-43, by Carl W. Nedderman, Rockwell Mfg. Co., American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

▼ ▼ ▼

Materials Under Alternating and Static Stress

The effect of temperature on the stress range diagram and the particular characteristics of the curves for unnotched and notched specimens are analyzed. Excluding metallurgical factors from consideration, it is suggested that relaxation is the principal mechanism which influences the behavior of polycrystal-line metals under combined alternating and static stress. Two parallel nonlinear Maxwell units are used to represent the relaxation mechanism at elevated temperature. An analysis of this model shows that relaxation occurs to an asymptotic finite value of stress which is a function of the initial stress. The same model is applied for representing the behavior in the stress range diagram with the assumption that a linear relationship exists at low temperature between the fatigue strength and the normal stress acting on the planes of reversed slip.

Based on a paper presented by F. H. Vitovec, University of Wisconsin, at the Metals Engineering Conference of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

For Literature on Cylinders, CIRCLE 199
For Literature on Hose and Fittings, CIRCLE 200

PARKER-HANNIFIN FLUID SYSTEM COMPONENTS

Hannifin high-pressure hydraulic cylinders feature a drip-free rod gland with "LIPSEAL"® and "WIPERSEAL." This feature, plus straight-thread, O-ring-sealed ports, insures leak-proof cylinder installations.

Parker "Krimp-lok" permanent-end hose assemblies and "Hoze-lok"® reusable fittings can be ordered with O-ring-sealed straight threads to insure leak-proof hydraulic connections to 5,000 psi.

from **PARKER-HANNIFIN...**

straight-thread ports and fittings

for leak-proof

hydraulic systems

Both Parker "Triple-lok"® flare-type and "Ferulok"® flareless fittings include straight-thread shapes in steel and stainless steel for leak-free tube connections. Write for our handy "Fittings Finders" for quick selection of Parker tube fittings, hoses and hose fittings.

Parker straight-thread hydraulic fittings, mated with S.A.E. bosses (offered at *no extra charge* on Hannifin cylinders), guarantee leak-proof cylinder port connections.* This use-proved sealing method is J.I.C. recommended.

To insure leak-proof performance throughout your hydraulic systems, Parker offers both "Triple-lok" flare-type and "Ferulok" flareless fittings for leak-proof tube connections. Where you need high pressure, permanent-end hydraulic hose assemblies, Parker supplies "Krimp-lok." And for fast, leak-proof field service or replacement, Parker "Hoze-lok" fittings require no skiving of the hose, need a minimum of tools for assembly.

Your Parker-Hannifin man is qualified to help you with installation problems. He'll also help you plan your hydraulic layouts.

**Both Parker fittings and Hannifin cylinders are still available with "dry-seal" pipe threads.*

Parker FITTINGS AND HOSE DIVISION
17325 Euclid Avenue, Cleveland 12, Ohio

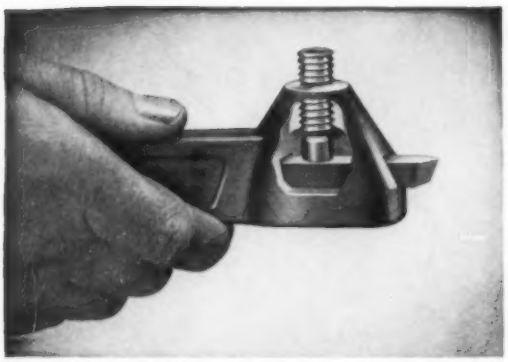
HANNIFIN COMPANY
545 S. Wolf Road, Des Plaines, Illinois

DIVISIONS OF PARKER-HANNIFIN CORPORATION

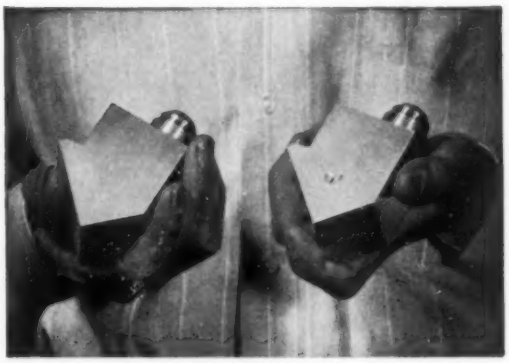
Practical Tooling Tips

NUMBER 1 OF A SERIES

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

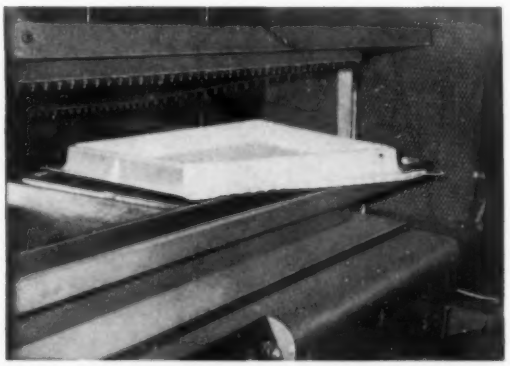


TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



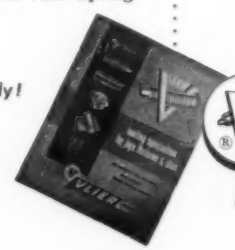
EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

New catalog now ready! Send for your copy today.

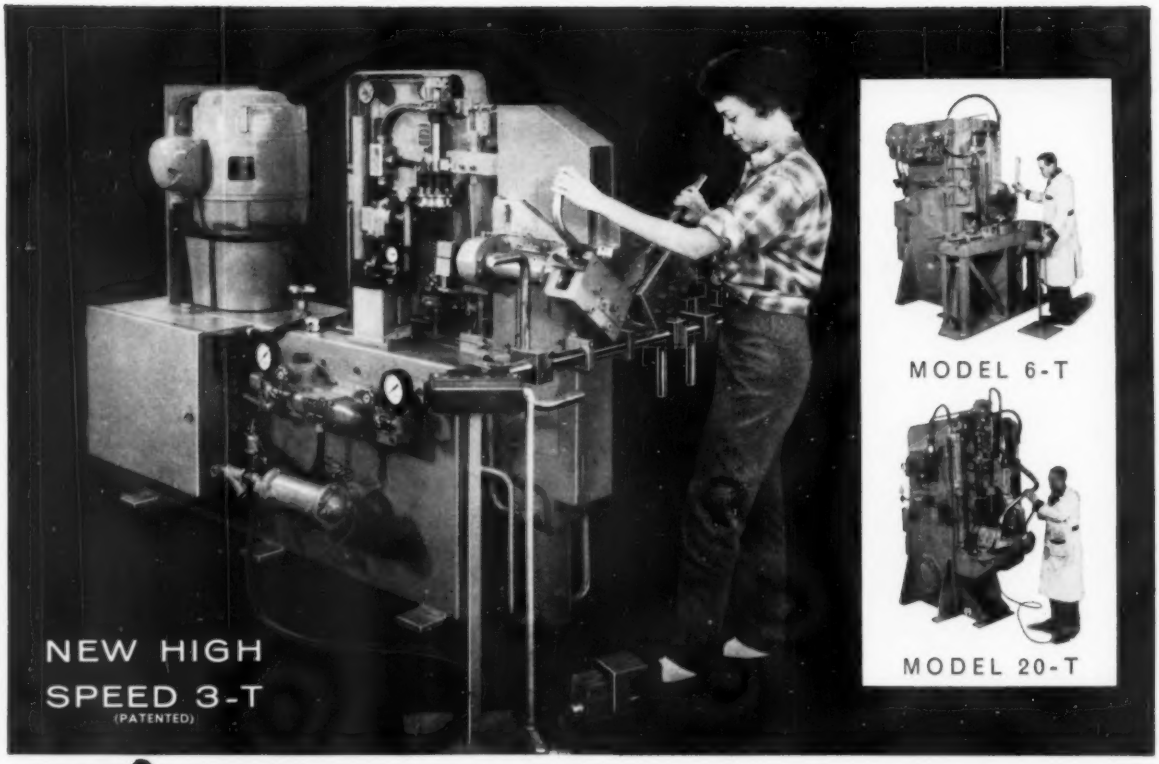


Insist on Vlier Tooling Specialties... there's still no substitute for quality.

VLIER ENGINEERING CORPORATION

A subsidiary of Barry Controls, Inc.

8900 Santa Monica Blvd. • Los Angeles 46, California



More Profitable Bending REPORTED FROM

INCREASED PRODUCTION, BROADER FLEXIBILITY, FASTER SETUP...

. . . **ON NEW PINES HIGH SPEED MODEL 3-T PRESS.** This new progressive bending press has proven the key to increased production, reduced costs on a variety of jobs in such industries as automotive, furniture, appliance, and farm equipment.

"INCREASED PRODUCTION" . . . reported by Bunting Co., Inc., Philadelphia. Accurate, quality bends are produced on the 3-T three times faster than by conventional methods. Speeds up to 1500 bends an hour on tubular parts up to 1" O.D.

"BROADER FLEXIBILITY" . . . says Kalamazoo Furniture Company, Kalamazoo, Michigan. Wide open tooling area permits rapid progressive bending in varied planes. Up to 10 different bend angles are automatically produced in a single setup with maintained plus or minus ½ degree accuracy.

"FASTER SETUP" . . . reported by Configured Tube Products, Bellwood, Illinois. Pick-out pins in indexing turret permit quick bend angle selection, are easily stored with stop gauges for repeat work. Quick change tooling contributes to fast, 15 minute setups.

✸ . . . **ON MODEL 6-T PRESS.** At Chromcraft Corporation, St. Louis, this multiple bending press saves time simultaneously forming "U" frames in two and three tubes per cycle at speeds up to 2000 bends an hour.

✸ . . . **ON MODEL 20-T PRESS.** At The AP Parts Corporation, Toledo, progressive bending of tubes up to 2" O.D. has increased efficiency 20% with speeds up to 800 bends an hour and near elimination of pass-along work-handling.

Get the complete profit story today. Write for New Catalog 379 on Pines Bending Presses

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery — **695 WALNUT • AURORA, ILLINOIS**

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

RUGGED to full tool capacity!

...FOR LONG WORKING LIFE
TO ELIMINATE DOWNTIME & PRODUCTION LOSSES!

THOMSON
THRIFTMASTER
DRILLHEADS

DRILL • TAP

REAM • BORE

COUNTER-BORE

COUNTER-SINK

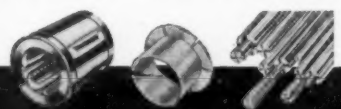
FACE

Tremendous economies from the use of multiple-spindle drillheads are obvious. Use *THOMSON* THRIFTMASTER Drillheads for optimum performance and profits. *Ask NOW for our new catalog.*

THRIFTMASTER
PRODUCTS CORPORATION

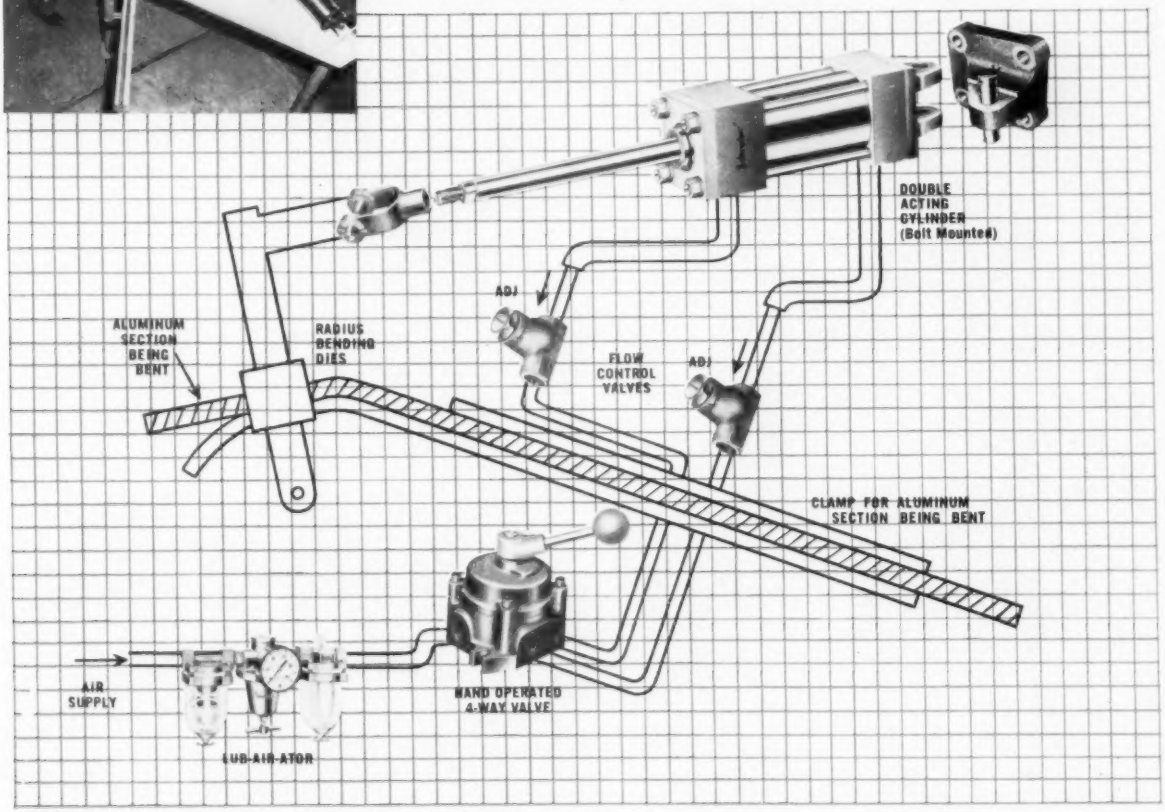
1012 NORTH PLUM ST.
LANCASTER, PENNA.
EXpress 2-2101

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS



Subsidiary of
THOMSON INDUSTRIES, INC.
makers of BALL BUSHINGS • NYLINERS • 60 Case Shafting

A typical example of how fabricators use Schrader. Schrader Air Products in the schematic perform a metal-forming operation at Lance Awning Corporation, Lake Worth, Florida. Power is supplied by a Schrader double-acting bolt-mounted air cylinder. By pressing the Schrader 4-way valve, the cylinder piston advances at proper speed, checked by Schrader flow control valves, bending an aluminum section to the desired angle. Reversal of the 4-way valve returns the cylinder and bending dies to rest, permitting removal of the bend section. "Air control provides a straightforward one-man job," says the Plant Manager. "Two men worked hard to form this radius bend on 25 parts per hour before a Schrader Air Cylinder was installed. Now one man forms 35."



FABRICATOR JUMPS PRODUCTION 40%... CUTS COSTS IN HALF WITH STANDARD SCHRADER AIR PRODUCTS

Get higher production at lower cost, just like this company . . . with the *air* you already have! You can't beat Schrader Air Products for accuracy, economy, speed —and lasting quality.

Air can save manhours . . . slash operating costs . . . upgrade practically any operation such as inspecting, assembling, testing and packaging. It can push, pull, hold, position and move work repetitively . . . make light of weight-lifting . . . accelerate production . . . unplug bottlenecks . . . all at unmatched low cost and drop-in-the-bucket maintenance.

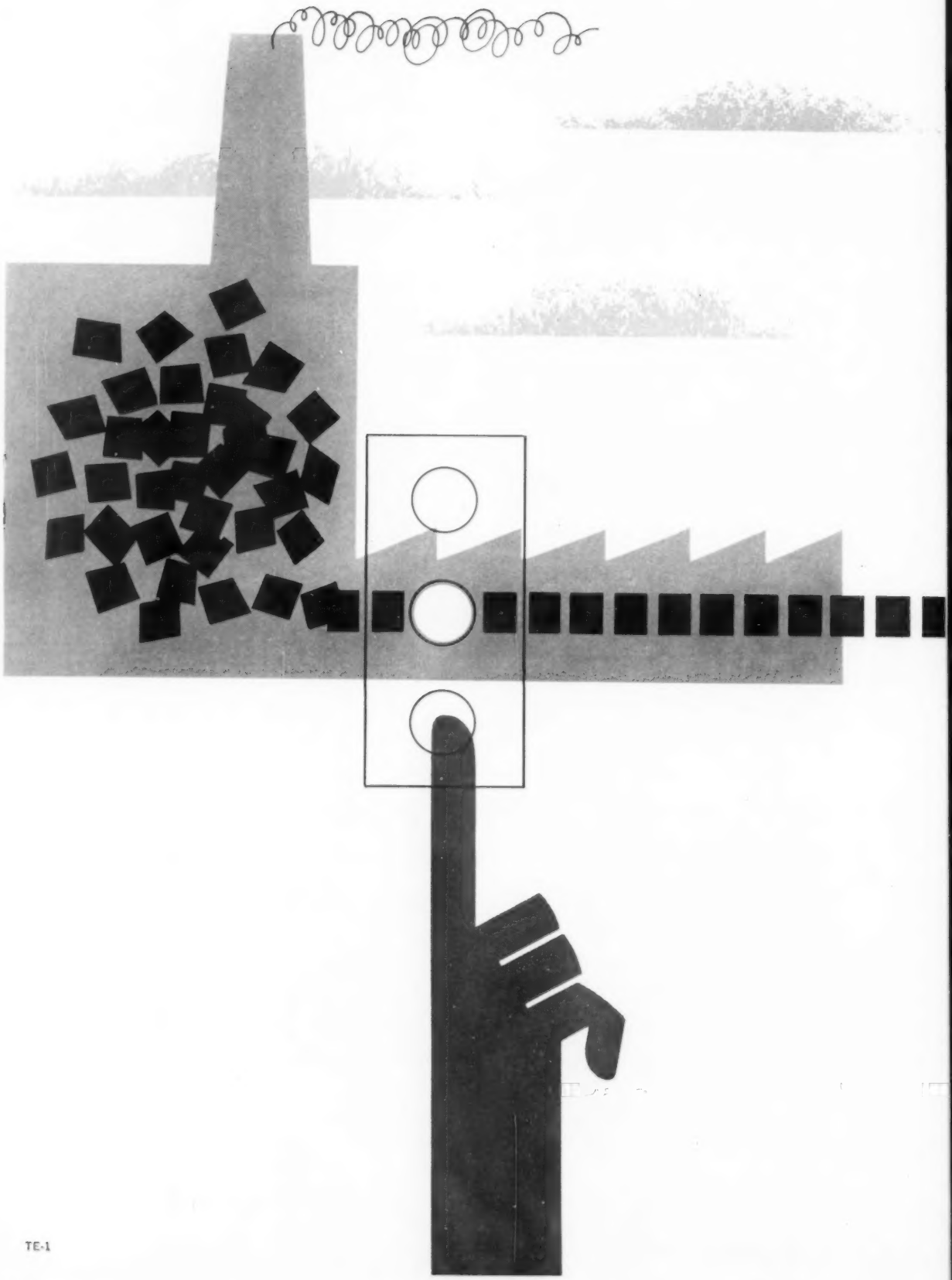
You get the finest line of Air Cylinders, Valves and Accessories from Schrader. Plan hookups yourself. You get expert help and ideas for cutting your operating costs from experienced Schrader Air Specialists.

Select your automating equipment from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data write:

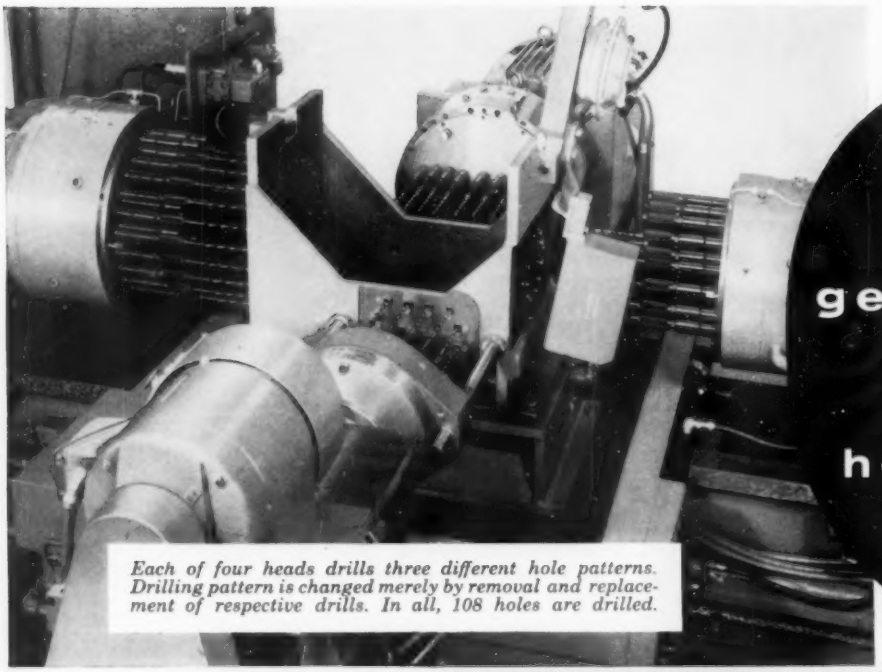
Schrader®
a division of SCOVILL

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS



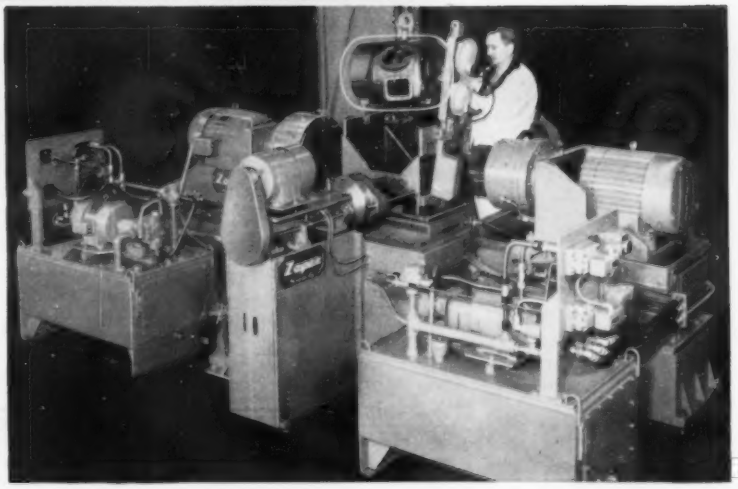
TE-1



Each of four heads drills three different hole patterns. Drilling pattern is changed merely by removal and replacement of respective drills. In all, 108 holes are drilled.

why gearless drill heads?

because Zagar *gearless design can use more spindles and do more work*



Zagar gearless design in multiple spindle machining permits a flexibility unmatched by any other equipment. Basically, the application of more and still more spindles is the key to savings in every stage of the job. From incipient engineering through cost per part (or cost per hole), every step is marked by cost-saving over any other approach. As spindles are added, cost per spindle actually decreases. This advantage obtains whether the head is designed to produce one part or more than one part of varying machining patterns.

When drilling, reaming and tapping on more than one part, Zagar can often apply one head to do several patterns. Zagar heads drill, ream, and tap varying diameters on any center.

Write for Engineering Manual A-2 for technical reference.

Zagar INCORPORATED

23892 Lakeland Blvd. · Cleveland 23, Ohio

USE MORE SPINDLES TO DO MORE WORK

which drill really costs less?

Based on results, drills "A" and "B" (center and right, above) should cost 43% and 39% less than W & B drills (left, above)—instead, they can be purchased at *only* about 20% less.

Watch those *initial* costs—they may be *costly!*

COMPARATIVE DRILLING PERFORMANCE

General Purpose Jobbers Drills	*No. of holes per drill size					Total No. of Holes	Efficiency Rating
	#40	#30	3/16"	1/4"	3/8"		
W & B Drills	208	62	57	50	34	411	100%
"A" Drills	142	24	14	28	28	236	57%
"B" Drills	114	49	13	61	15	252	61%
Thickness of plate	9/32"	3/8"	1/2"	1"	1"	Material: Heat treated chrome nickel steel	

**In each drill size, five drills of each brand were tested and each drill was resharpened three times as required.*

W&B

PARTNERS IN PRODUCTION PROGRESS

Many drill performance tests similar to this one have been made. However, W & B will gladly conduct drill tests at *your* plant and under *your* conditions. Contact us direct or through your W & B distributor. He can offer this service plus fast delivery from complete stocks.

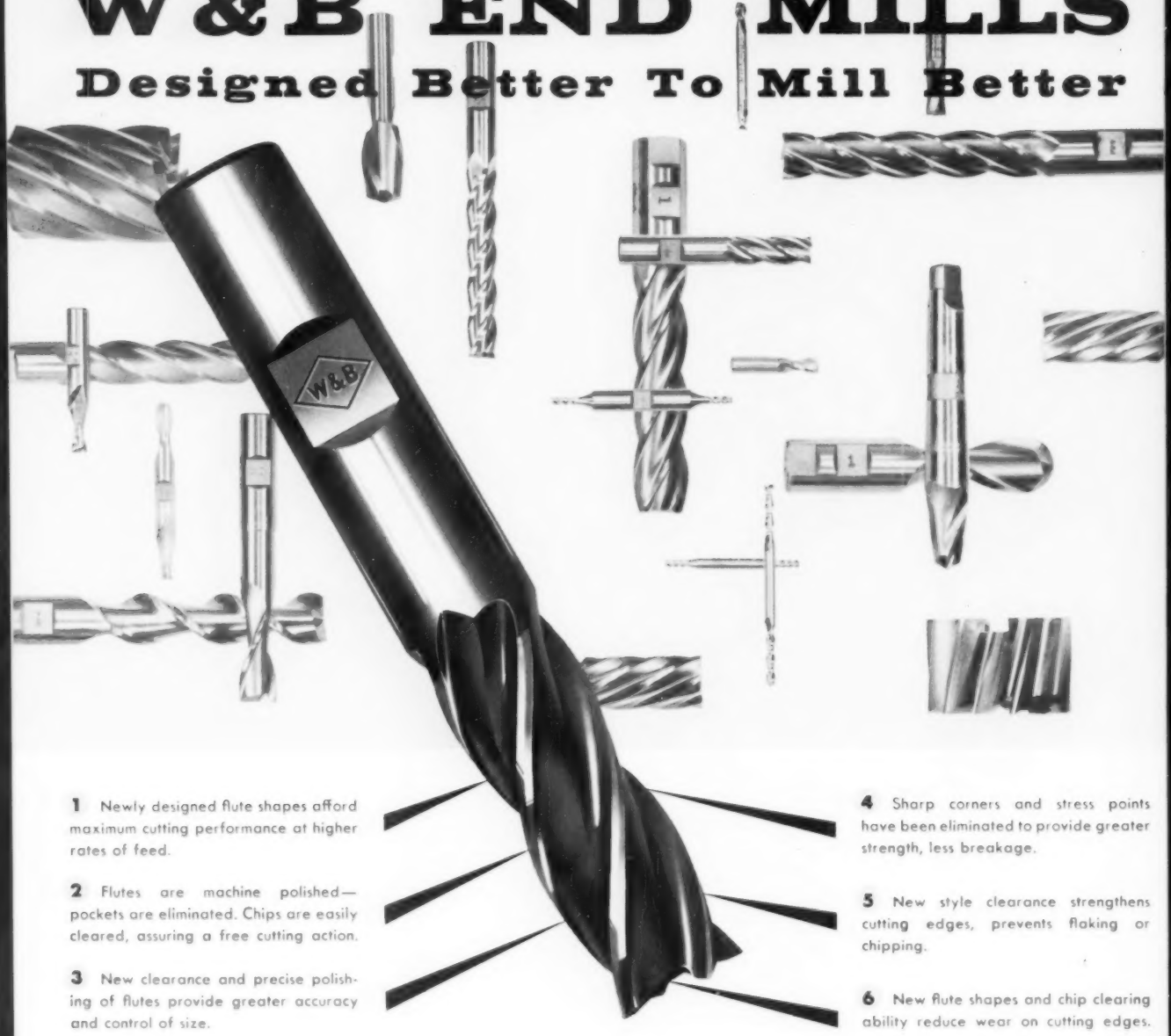
WHITMAN & BARNES

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

DRILLS • REAMERS • END MILLS • COUNTERBORES • COUNTERSINKS • CARBIDE TOOLS • SPECIAL TOOLS

W&B END MILLS

Designed Better To Mill Better



1 Newly designed flute shapes afford maximum cutting performance at higher rates of feed.

2 Flutes are machine polished—pockets are eliminated. Chips are easily cleared, assuring a free cutting action.

3 New clearance and precise polishing of flutes provide greater accuracy and control of size.

4 Sharp corners and stress points have been eliminated to provide greater strength, less breakage.

5 New style clearance strengthens cutting edges, prevents flaking or chipping.

6 New flute shapes and chip clearing ability reduce wear on cutting edges.

Every Feature Says Compare!

Try W & B end mills on your milling operations . . . a comparison will demonstrate their superior performance. Your local W & B distributor carries a complete stock of standard, off-the-shelf types and sizes. He offers you the best in service and delivery on end mills for any standard application—so, to make your own performance comparison, call your industrial distributor today!

W&B

INDUSTRIAL DISTRIBUTORS

THE RIGHT HAND OF PRODUCTION

PARTNERS IN PRODUCTION PROGRESS

WHITMAN & BARNES

MAKERS OF FINE TOOLS SINCE 1848

DRILLS AND REAMERS

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

NEW YORK CHICAGO LOS ANGELES

DRILLS • REAMERS • END MILLS • COUNTERBORES • COUNTERSINKS • CARBIDE TOOLS • SPECIAL TOOLS

Supremacy

in cutting high temperature alloys,
ultra high strength alloys, special and rare metals

broaching

A-286
S816
Udimet 600
Udimet 700
M-252
19-9-DL
AISI/SAE 4140 (Rc 41-43)
VascoJet 1000 (Tensile Strength 270,000)
Discalloy
Waspaloy
Nimonic 80
Zirconium
Titanium Alloys

milling

Pure Molybdenum
AISI/SAE 4340 (Rc 40)
Titanium Alloy (4% Al—4% Mn)
A-286 (Solution Treated Br 312)
310 (Rc 45)
Zirconium
Zircaloy #1
Zircaloy #2

hobbing

AISI/SAE 4342 (Rc 47)
AISI 8660 (Rc 45-50)
AISI/SAE 1050 (Rc 47-50)

turning

302
HS 25 (Solution treated to Br 207)
Nimonic 80
Nichrome 526
Inconel 901
Inconel 700
Udimet 500
R 235
All solution treated high temperature alloys

drilling

AM 350 (Solution Treated and aged to Rc 47)
AISI/SAE 4340 (Rc 44-55)
VascoJet 1000 (Rc 52)
Refractalloy

planing

VascoJet 1000 (Br 350, 400, 500)

VASCO

SUPREME®

Vasco Supreme is being used successfully for machining the special metals and alloys here listed—often when other cutting tool materials, including carbides, have failed. • In addition, of course, Vasco Supreme delivers outstanding performance throughout industry in machining heat-treated steels of standard compositions, and hard and abrasive materials such as cast iron, cast steel, aluminum and plastics, etc. • Whatever the areas of your difficult cutting assignments, specify unique Vasco Supreme for performance surpassing by many times that of any other high speed steel. Let us counsel you on latest applications techniques.

Our 50th VA Anniversary

Vanadium-Alloys Steel Company
LATROBE, PENNSYLVANIA

DIVISIONS: Anchor Drawn Steel Co. • Colonial Steel Co. • Metal Forming Corporation • Pittsburgh Tool Steel Wire Co.
SUBSIDIARIES: Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Società Italiana Per Acieri • EUROPEAN ASSOCIATES: Société Commerciale Des Aciers Fins Vanadium-Alloys (France) • Rasmussen Engineering Società Italiana (Italy)

Use Reader Service Card, CIRCLE 139

COMPETING WITH A COMPANY WHO GRINDS PARTS UP TO 50% FASTER?

If you are grinding parts like these on other than a Bryant Centalign® you are losing out to competitors who do.

This fact is proven by the many manufacturers who are setting production records and improving their competitive position—with Bryant Centaligns.

Only the Bryant Centalign with its advanced design principles enables you to grind straight bores, tapers and precision bearing raceways with consistent accuracy at record breaking production rates.

Investigate what the Bryant Model "C" Centalign and its tooling, job engineered for quick change over and minimum down time, can do for you.

Inquire, too, about the Bryant Vertical Centalign (for cam-type parts) and the Bryant Model B Centalign for miniature and instrument bearing work.

BRYANT Chucking Grinder Co.

58 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N.Y. • Philadelphia

Internal Grinders • Special Machinery

Sue Perior and Spouse

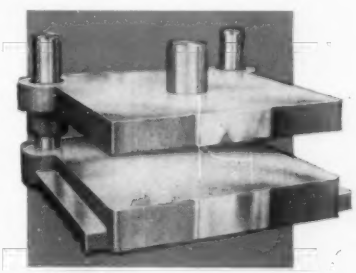
THE *Exclusive* SET

Exclusiveness is a distinction . . . the reward for challenge and accomplishment.

Superior engineers are constantly alert to the challenges of the die making industry. And through research and engineering skills they have met the challenges and created die sets with exclusive features that have contributed to the die maker's art.

Superior's exclusive features have brought advances to die making and they have brought die set leadership to Superior. Let Superior's many exclusive features work for you!

Get Superior . . . the exclusive set!



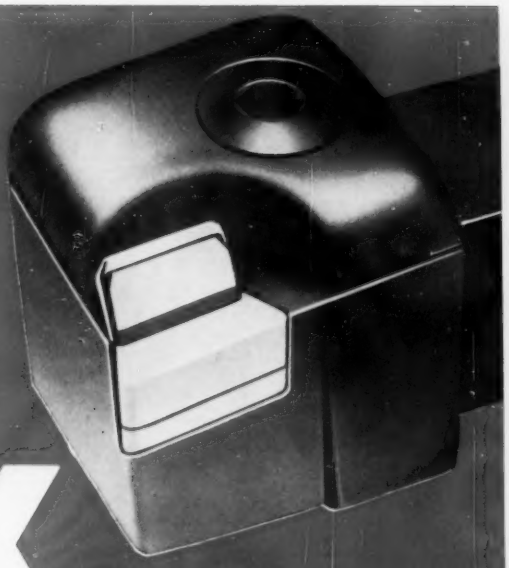
Write for the new catalog, today!

SUPERIOR STEEL PRODUCTS CORP.

2754 South 19th Street • Milwaukee, Wisconsin

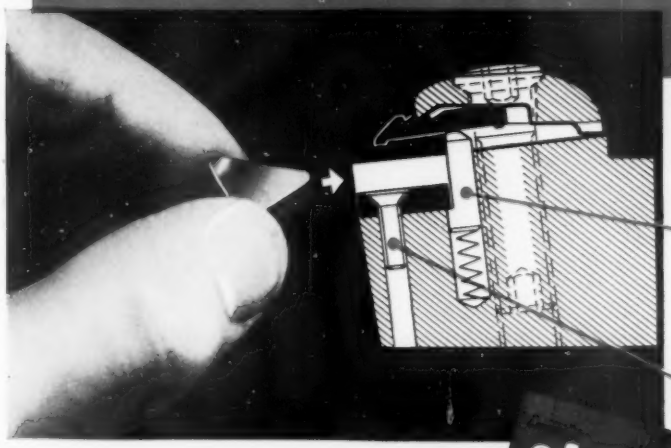
Manufacturing Plants at Milwaukee, Wisconsin and Cheshire, Connecticut

ONLY SANDVIK *Coromant*



T-MAX Adjustable Toolholder

Gives You These 3 Cost-Cutting Advantages



1. **LOW INITIAL COST** — for complete toolholder, holds down inventory investment. Triple purpose, solid carbide chipbreaker cuts replacement expense, too.
2. **FASTEST, SIMPLEST CHANGING** — Exclusive "Auto-Lift" pin automatically lifts and holds *both* the three-position chipbreaker and clamp *clear of the insert for fumble-free indexing or replacement.* A simple push clicks the chipbreaker into desired position for light, medium or heavy cut.
3. **"NON-BINDING" SHIM PIN** — Shim held by exclusive tempered spring pin. No screw to freeze or bind from machining heat.

Available in a wide range of styles and sizes in positive and negative rake holders to handle almost any machining job. Send for free catalog or contact your nearest Coromant distributor today.

SANDVIK STEEL, INC.

1702 Nevins Road • Fair Lawn, N. J. • Tel. SWarthmore 7-6200

In N. Y. C., ALgonquin 5-2200

CLEVELAND • DETROIT • CHICAGO • LOS ANGELES

SANDVIK CANADIAN LTD. • P. O. Drawer 1335, Sta. O., Montreal 9, P. Q.

SANDVIK

FROM ORE TO FINISHED PRODUCT WITHIN THE SAME COMPANY

Visit Our Exhibit At The ASTE Tool Show, Detroit, April 25-29, Booth # 227

Punchability + REPORTS

Check Report Desired

☐ **R. R. 22** **Tool Wear in Cutting Thin-Gauge Sheet Steels by Otto and Werner Kienzle**

Translation from German, made available by Armco Steel Co., embodies new data, tells of research in 3 groups of sheet materials, why rough punched faces are preferred. *Price .75 (non-member 1.50)*

☐ **R. R. 23** **Superfinishing of Die Parts—What are the Advantages and Disadvantages? by E. Griffiths**

Summarizes replies received from a questionnaire sent to the Metal Stamping Committee. Highlights the wide difference of opinion held by authorities. *Price .75 (non-member 1.50)*

☐ **R. R. 24** **Break Clearance Standards and Control by E. Griffiths**

Summarizes replies received from a questionnaire sent to the Metal Stamping Committee. Highlights the wide difference of opinion held by authorities. *Price .75 (non-member 1.50)*

☐ **R. R. 25** **Proposed Test Method for the Determination of the Punchability Rating for Electrical Steels by E. Griffiths**

Discussion of the variables in punchability testing. Emphasizes the need for a more thorough understanding of the basic principles involved in measuring punchability. Outlines a suggested research project. *Price .75 (non-member 1.50)*

☐ **R. R. 26** **Development of a Punchability Rating Method for Electrical Steels, Phase I by Professor John E. Biegel**

Covers Phase I of the research undertaken by Syracuse University. Initial test conditions are established. Seventy-five item bibliography included. *Price .75 (non-member 1.50)*

Clip, fill out and mail Today!

To: American Society of Tool and Manufacturing Engineers
Publication Sales Dept., 10700 Puritan, Detroit 38, Michigan

Ship to.....

Address.....

City..... Zone... State.....

Chapter No. (if member).....

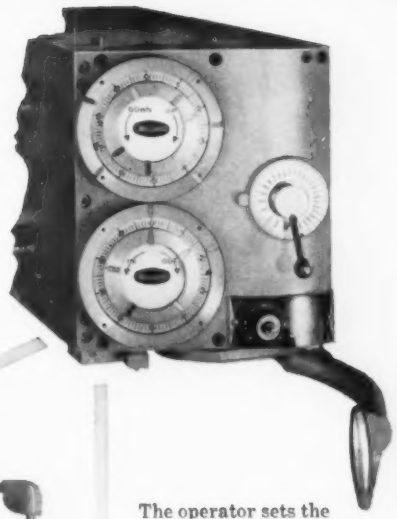
Check, Money Order, or Company Purchase Order must accompany order.

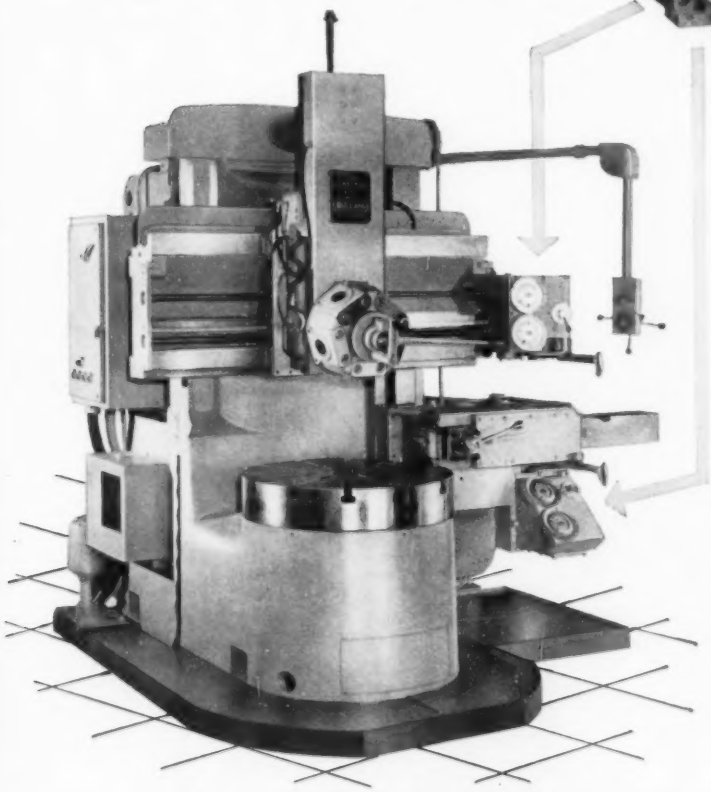
BULLARD

DYNATROL* V.T.L.

Obsoletes Handwheels

A completely new concept in measuring, utilizes large, easy to read, clock-type dials with dual pointers.





The operator sets the movable clips, around the dial, to conform with the workpiece requirements and by rotating the pointers to these settings he *knows* the tool is precisely located for the operation to be performed. The graduations and numerals remain stationary while the pointers rotate, one registering tenths of an inch and the other thousandths, for exact head positioning.

When coupled with the unique DYNATROL* control, this accurate measuring system eliminates the need for handwheels, for head-positioning, in either feed or traverse and increases the productive time of the machine.

* Trade Mark

Ask your Bullard Sales Representative about the many other features which make the Bullard DYNATROL* the *first* fully power-controlled vertical turret lathe.

THE BULLARD COMPANY, Bridgeport 9, Connecticut.

High-Spot Features of the DYNATROL* V.T.L.

Dynatrol V.T.L. is POWER CONTROLLED

By lever or pendant—it's your choice—head traverse rates can be varied from zero to nine feet per minute. Easy-to-read dials show exact position.

Feed selector gives infinitely variable feed rate without interrupting the cut.

Dynatrol V.T.L. is VERSATILE

Available equipment includes:

Bullard variable speed drive for infinitely variable table speeds throughout the full range with no loss of usable horsepower.

Fully automatic operation by Bullard Man-Au-Trol or point-to-point or continuous path numerical control systems.

Unique Size-Au-Trol* for accurate positioning of all heads. Contouring attachments: Hydraulic, electronic or electro-hydraulic. Four- or five-sided power-indexing turret heads. Thread cutting, drum scoring and angle turning attachment. Power-operated chucks.

Dynatrol V.T.L. is COMPACT

The new Bullard Dynatrol V.T.L. is compact in design, rigid in construction, lower in height, reduced in floor area.

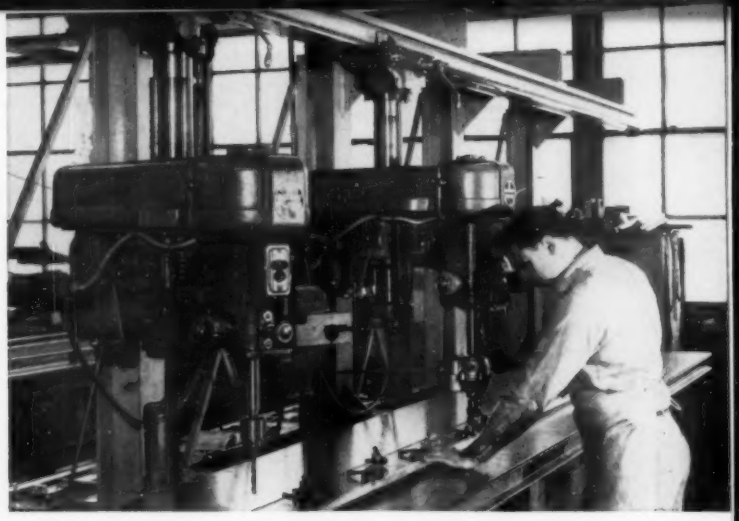
Dynatrol V.T.L. is EASY TO MAINTAIN

Automatic lubrication throughout... fewer parts... fewer adjustments... easily accessible.

"YOU CAN'T BEAT A BULLARD"

3 WAYS you can use

WT ALKER-TURNER



Rail mounted standard components

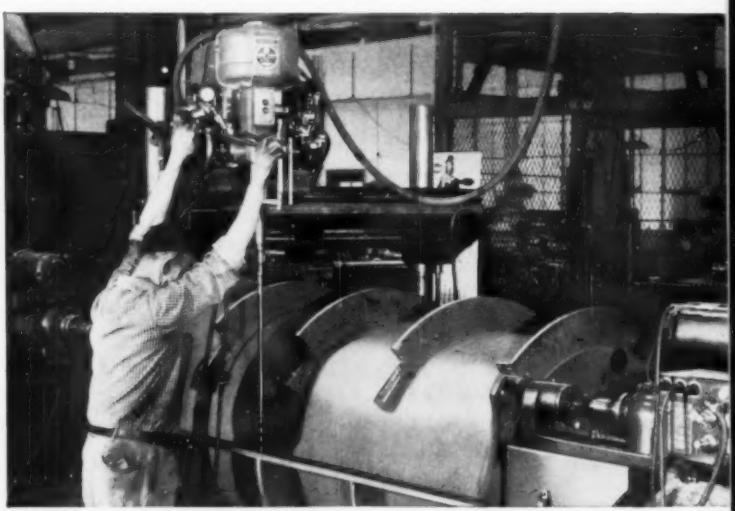
20″ drill presses to cut costs

Here are just three of the many ways you can save money using Walker-Turner "Light Heavyweight" 20″ drill presses for drilling and tapping operations. For standard applications or in special setups, you'll find that these fast, accurate, low-cost tools really pay off in performance. And they offer the *extra* value you look for because they're built to withstand years of heavy duty production line use with little or no maintenance.

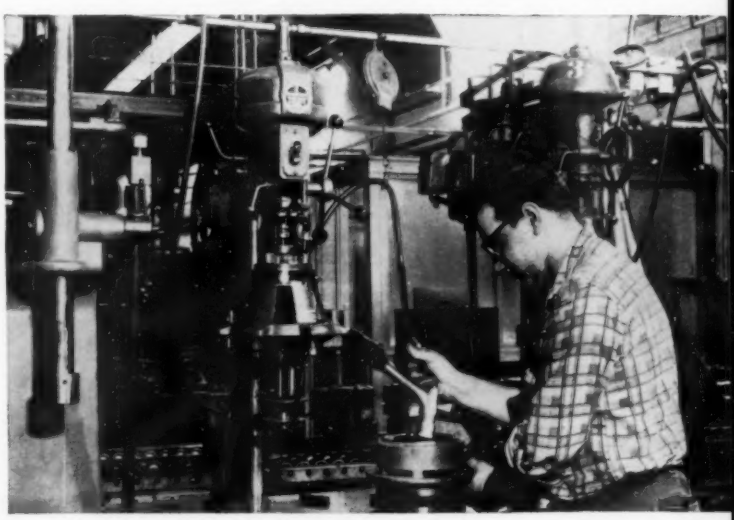
Ask your Walker-Turner Distributor (listed under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages) about the money-saving advantages of using W-T tools and components. He'll gladly show you the full line of Walker-Turner 20″, 17″, 15″ and new 14″ Hi Speed drill presses in a variety of floor, bench and single or multiple spindle models to fit *your* needs.

For **FREE CATALOG** of the complete line W-T metalworking tools, write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. **WC-25,** 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL



Carriage mounted special setup



Equipped with multiple spindle attachment

Visit Walker-Turner in Booth No. 2236 at the A.S.T.E. Show

Use Reader Service Card, CIRCLE 150

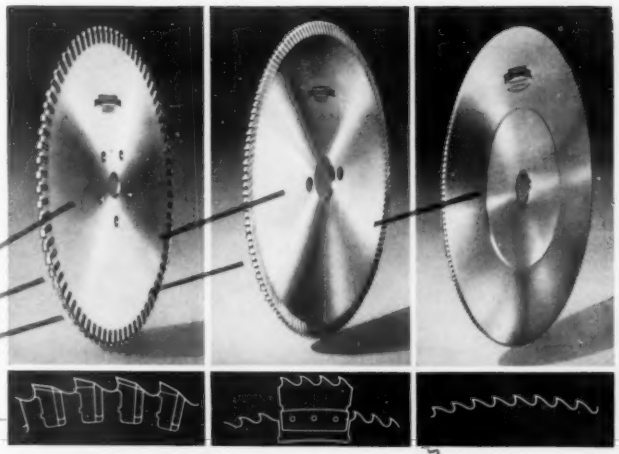
Do you cut ferrous metals? If so, Simonds has three basic saw designs for you:

INSERTED TOOTH METAL SAWS

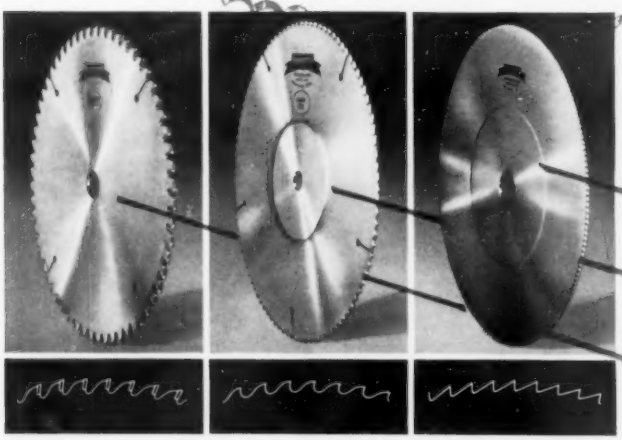
SEGMENTAL SAWS

SOLID TYPE SAWS

Available in High Speed and Semi-High Speed Steels



There's a SIMONDS Circular Saw Exactly Right for Your Metal Cutting Job



If you're cutting non-ferrous metals, Simonds offers you:

SOLID STEEL SAWS
Available in "Si-Maloy", in High-Speed Steel for cutting where extreme abrasiveness is present, and in Semi-High Speed Steel.

HIGH SPEED STEEL, HARD RIM SAWS
Hard cutting edge, soft center gives you long life coupled with safety.

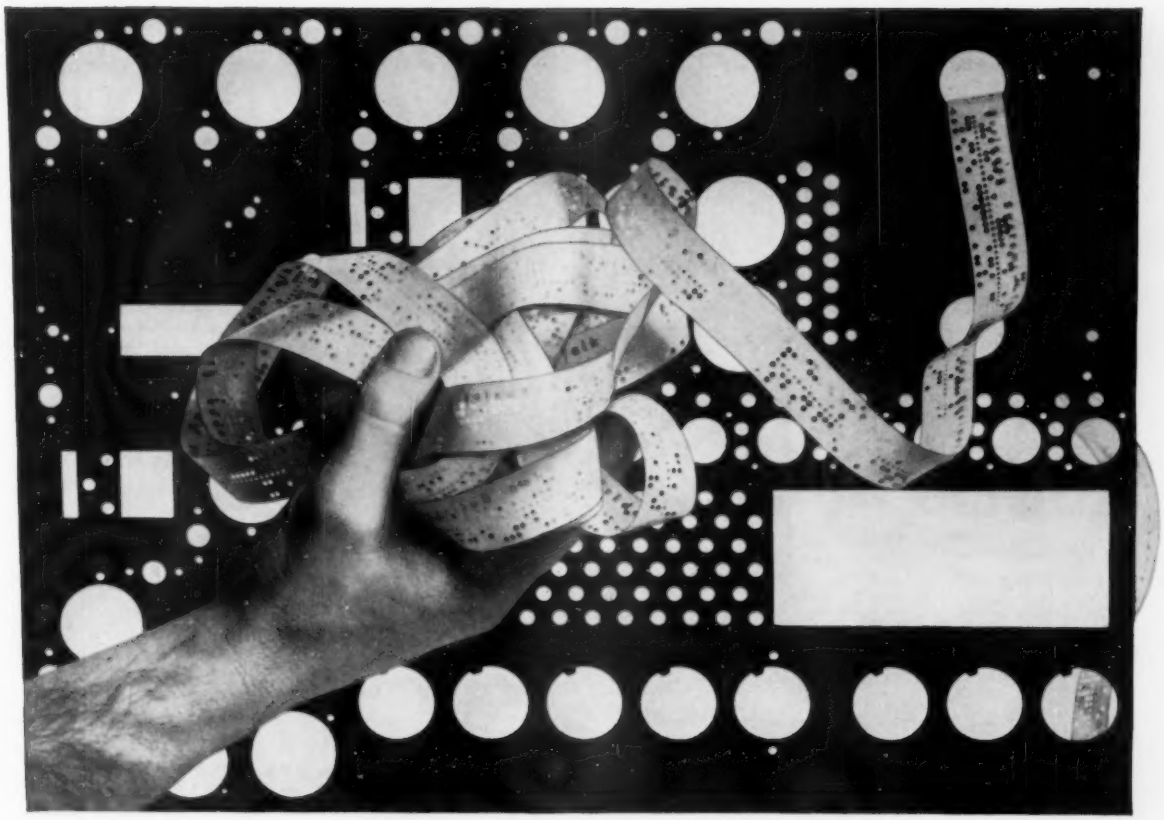
CARBIDE TIPPED SAWS
for cutting aluminum and magnesium, as well as other non-ferrous metals

No matter what kind of metal you're working, there's a quality Simonds blade just right — a blade that means faster, cleaner cuts, longer blade life and maximum performance.

Find out how a Simonds Circular Metal Cutting Saw can mean important savings for you.

For Fast Service from Complete Stocks Call your SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.



A HANDFUL OF TAPE
A HATFUL OF PROFITS

A Wiedematic gives you all the benefits of tape control plus the unmatched flexibility of a turret punch press for low, medium and high quantity production. Increased productivity is only a part of the story. The true value of Wiedematic is in major savings and increased efficiency all the way from drawing board to final assembly.

Such extra advantages as simplified engineering and work processing techniques . . . elimination of repeated blueprint interpretation . . . reduced inventory and many other cost cutting factors — these are only a few ways the Wiedematic will give you a hatful of profits.

Get full information. Write today for a bound copy of the Wiedematic story.

Wiedematic Turret Punch Presses are available in capacities from 15 to 150 tons

MMT-PE

SEE WIEDEMATIC IN ACTION
BOOTH 1249
MACHINE TOOL EXPOSITION

WIEDEMANN
MACHINE COMPANY
TURRET PUNCH PRESSES

DEPT. TE-3 • GULPH ROAD • KING OF PRUSSIA, PA.

Use Reader Service Card, CIRCLE 154

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 171.

Can you put your finger on machining economies like this?

Cost of 800 brazed single point tools at approximately $3.50 each

TOTAL
$2,800.00

Cost of 100 square CARMET INDEXABLE INSERTS with 800 cutting edges at

APPROX.
$100.00

In addition to these savings on machining, you gain in high production rates, longer tool life, in longer tool storage and inventory, as well as tool change downtime.

Over 9 styles and 109 sizes Carmet cadmium plated tool holders. 6 carbide grades for machining almost all materials from wood and plastics to high alloy steels.

then it's time to switch to CARMET® INDEXABLE INSERTS AND TOOL HOLDERS

Write for New-Revised CATALOG C-16-B
CARMET CEMENTED CARBIDES FOR INDUSTRY

This 32-page book contains revised prices and complete specifications on Carmet's full line of cemented carbide tipped tools, blanks and holders. Speed and feed charts, grade comparisons and ordering information included.

Address Dept. TE-27

See your Carmet Distributor now—or write to Carmet Division, Allegheny Ludlum, Detroit 20, Michigan.

147

CARMET

CEMENTED CARBIDE DIVISION OF
ALLEGHENY LUDLUM STEEL CORPORATION

AL®

Cutting fine threads on thin-walled tubing stumped a Mid-western plant. After only 100 operations, tool edges burned dull...tool-chatter roughened threads.

Sinclair engineers came... studied...solved the problem with Sinclair TRUKUT® EP Soluble Oil. Its better cooling and load-carrying capacity increased production 400%

Now threads are smooth... tools take on new life. Profits no longer go up in smoke.

If you have problems, a Sinclair engineer can help you solve them with one of Sinclair's 500 specialized products. Call your local representative or write...

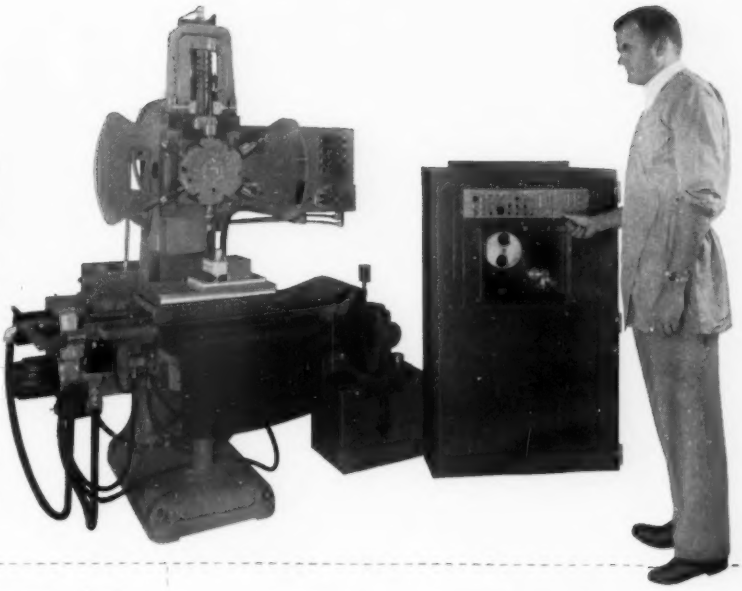
Sinclair

SINCLAIR REFINING COMPANY

TECHNICAL SERVICE DIVISION • 600 FIFTH AVE., NEW YORK 20, N. Y.

For significant tooling and labor savings

HUGHES 2-AXIS MACHINE TOOL CONTROL



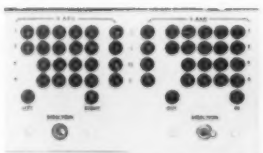
The new Hughes Numerical Control offers you significant savings in tooling and labor costs for all of your high-speed, precision operations—drilling, boring, turning, riveting, spot welding, eyelet inserting, and many others. Easily adaptable to new machines or for retrofit, the Hughes Numerical Control provides you with automatic positioning of a two-axis table, with third axis feed control if desired.

See the HUGHES Numerical Control in operation in Booth 2117 at the ASTE Show, Detroit, April 21-28.

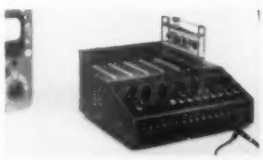
Advantages of the new Hughes 2-axis machine tool control

1. *Greater dependability* through use of transistorized circuits and mercury-wetted relays.
2. *High-precision repeatable accuracy:* ±0.0002", non-cumulative. Input resolution: 0.001".
3. *Faster operation:* Two axes positioned simultaneously. Creep-traverse drive unit provides high-speed positioning at 180 inches per minute. High-speed information input from optical tape reader.
4. *Saves valuable floor space:* Compact cabinet occupies minimum area.
5. *Higher accuracy and greater reliability* is assured by use of a digital system with photo-electric position transducers.
6. *Permits use of existing tape preparation equipment.* Uses standard 1", 8-track, perforated tape. (Lower-cost Hughes tape preparation unit is available.)
7. *Versatility in operation* with 3 operating modes: 1) Automatic, 2) Set-up (for tape and programming checking), 3) Manual.
8. *Fast, easy, low-cost maintenance:* Modular construction with easy-to-replace plug-in units. Uses standard industrial drive motors and clutches; 115v single-phase power.

CHECK THESE EXCLUSIVE FEATURES!

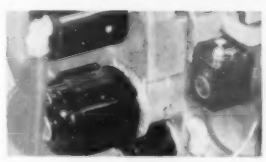


Easier set-up and checking: Display lights on control panel indicate coordinate dimensions to provide operator with means of verifying accuracy of programming.



Easier electrical maintenance: Easy-to-use insert tester enables present maintenance personnel to keep Hughes Numerical Control operating. No technicians required!

Longer tape life plus extra accuracy: Photo-electric tape reader eliminates deformation of tape holes; reduces possibility of wear and tearing. Unit requires no pneumatic or hydraulic connections.



Easier mechanical maintenance: Table drive unit employs standard industrial electric motors and clutches for easy replacement and/or repair.

For further information on the Hughes Machine Tool Control... and its applications to your specific needs... please write or wire: HUGHES, Industrial Systems Division, International Airport Station, Los Angeles 45, California.

For export information, write: Hughes International, Culver City, California

Creating a new world with ELECTRONICS

HUGHES

INDUSTRIAL SYSTEMS DIVISION

Holds to watchmakers' tolerances, extends tool life 4 times

GULF MAKES THINGS

Fishing reel parts and small precision components for the aircraft industry don't seem to have much in common, except at Scripco Manufacturing Company, Inc., of Laingsbury, Michigan.

Scripco specializes in machining small pieces to exacting specifications. Take spinning reel drive gear stems, for example. When completed they're 1.341" long. Scripco cuts them from B1113 steel in a single-spindle Brown & Sharpe at 230 sfm. Diameters (eight of them) must be held to tolerances of .0001". Length must be held to .008", thickness to .002" and concentricity to within .002". Made in 6 operations, pieces take 25 seconds to complete.

"To stay out of trouble on this job, we use Gulfcut 41C," says partner Frank Scripter. "It has just the right amount of sulfur to reduce cutting drag, without corroding the fine threads on this piece."

On another job—machining phosphor bronze pieces—Scripco quadrupled tool life by switching to Gulfcut. Previously they got only 1½ hours of tool life—now with Gulfcut they get a full 6 hours before regrinding.

Frank and James Scripter, brothers and owners of Scripco Manufacturing Company, Inc., Laingsbury, Michigan, show samples of small components to Herman Johnson, Gulf Sales Engineer.

Scripco uses Gulfcut 41C for machining type 416 stainless, B-1112 and B-1113 cold rolled steel. For tough and draggy type 303 stainless, Gulfcut 31C is used.

GO-9-7421

with Gulfcut® oils . . .

RUN BETTER!

"With Gulfcut oils we can meet the exacting tolerance and finish specs required by the aircraft industry and our other customers. We can do it economically, too, because longer tool life means a smoother flow of production" says James Scripter.

See for yourself how Gulf makes things run better! Just call your nearest Gulf office. And use the coupon to get your free copy of the new 116-page manual "Metal Machining with Cutting Fluids." It contains complete information on cutting oil selection and usage.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.

Send free copy of "Metal Machining with Cutting Fluids."

Name_____

Title_____

Company_____

Address_____

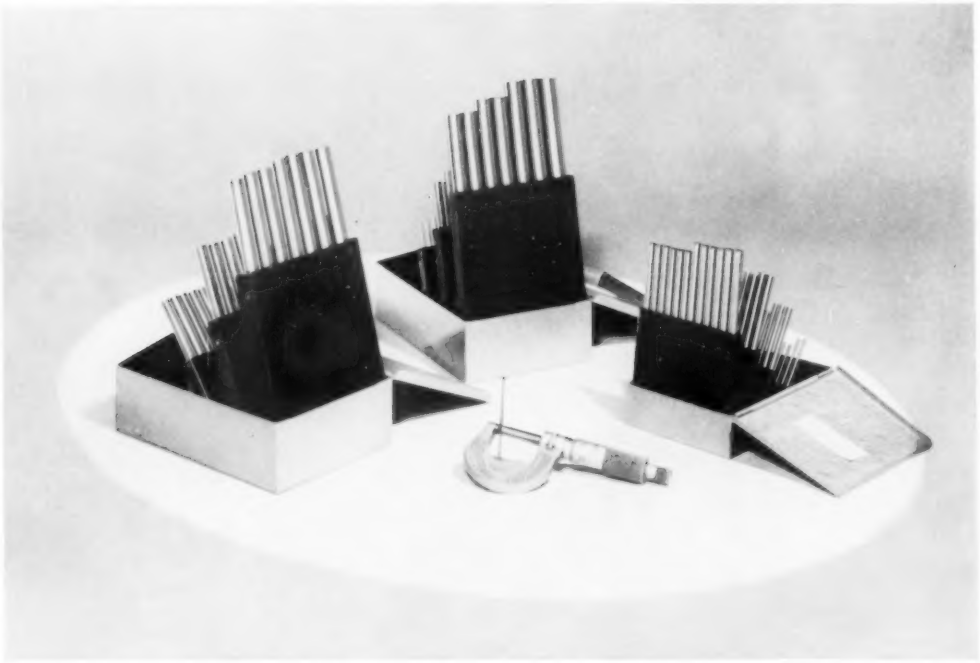
City_____ Zone____ State_____

DRexel 6-4222 ESTABLISHED 1927

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

your choice of two tolerances
+ .0002" − .0000
or
+ .0000 − .0002"

JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

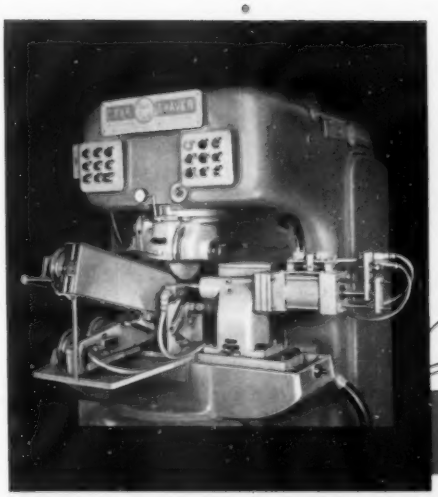
HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish — parallel ground.

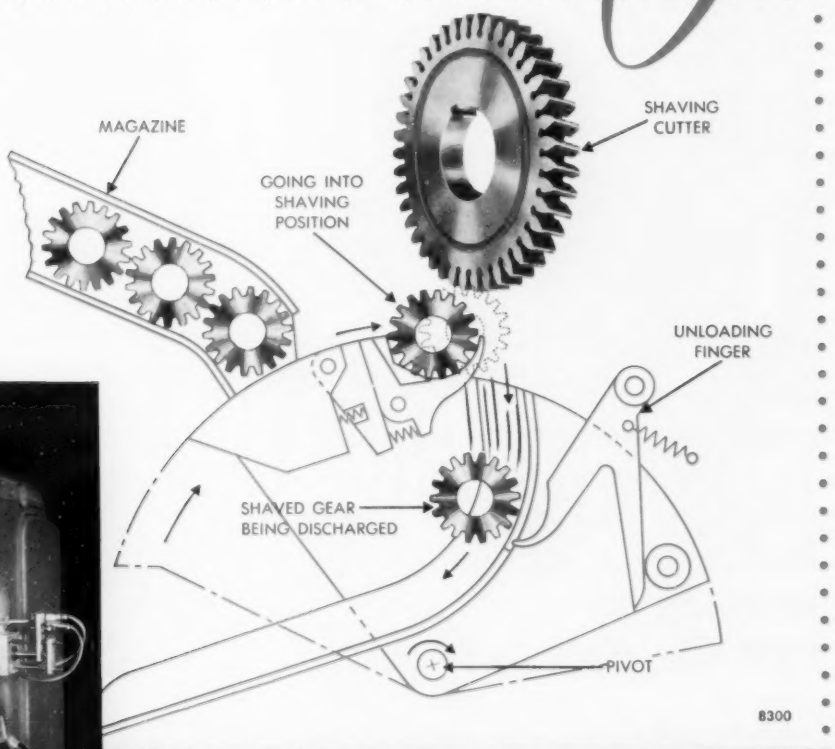
ANY DECIMAL DIAMETER OF STANDARD LENGTH .010" TO 1.000" SHIPPED ON 24 HOUR NOTICE

WHY SETTLE FOR ONLY **75%**

OF THE PRODUCTION YOU CAN GET WITH

AUTOMATIC GEAR SHAVING





RED RING ROCKER-TYPE AUTOMATIC LOADER
(PATENTED)

Production you can expect from automated gear shaving is determined by the type of automatic loader you use.

You get maximum production when the loader moves a gear from the magazine into shaving position and discharges its shaved predecessor — **all at the same time.** This assures maximum cutter operation.

If, on the other hand, the loading of a fresh gear has to wait until the previous gear has been discharged, shaving is delayed and you get only about 75% of the production you could otherwise expect.

The standard Universal Red Ring Gear Shaving Machine may be automated for MAXIMUM PRODUCTION — and without any major revisions in its design. Write for details.

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

A HAUSER JIG BORER runs itself ...well almost!

HAUSER JIG BORERS assure your operator of a FATIGUE FREE DAY and you of a PROFITABLE one. They are designed with you **both** in mind.

All controls are easily accessible from one central location, and from a seated position. The Vernier Scales are LARGE . . . very LARGE, and easy to read ACCURATELY. There are TWO controls for each coordinate motion . . . one for setting to the thousandth and a fine adjustment for the final tenth. Eliminated is the old "tapping on the handwheel" for the last tenth.

Combining EASY and ACCURACY, HAUSER must mean PROFITS.

THE 10 HAUSER JIG BORER MODELS ARE GUARANTEED FOR SLIDE LOCATION WITHIN 0.0001" TO 0.0002" DEPENDING ON SIZE

hirschmann

Swiss precision with American service

The Carl Hirschmann Company Inc., is proud to represent the HAUSER factory, and extends its nationwide, unexcelled service facilities to all HAUSER users.

CARL HIRSCHMANN COMPANY, INC.

30 Park Avenue, Manhasset, N. Y.

Branches: 6015 N. Cicero Ave., Chicago 46, Ill. • 5124 Pacific Blvd., Los Angeles 58, Calif.
Carl Hirschmann Co. of Canada, Ltd., 5112 Dundas St., West, Toronto, Canada

Stabilized two-stage flame, no additives

One of a series

The burning question of cool flames

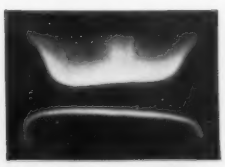
Between the brief stage of not burning and burning, many hydrocarbons react with oxygen at temperatures well below that of normal flame combustion. But the reactions are usually transient and hard to analyze. At the General Motors Research Laboratories, we have been able to investigate the *effect of chemical additives on cool preflames.*

To do this, the almost invisible cool flames are stabilized for hours in a flat-flame burner, permitting careful examination of the retardation or acceleration effects of the additives. From more than twenty additives studied, experimental results indicate that some chemicals affect combustion through the mechanism of preflame reactions. We are now accumulating new information on these additives' mode of operation. For instance: emission spectra support the conclusion that tetraethyl lead reacts with the oxygenated compounds formed in cool flames to yield lead oxide vapor. These findings of when and how lead oxide is formed are important in resolving a current controversy of science — the combustion behavior of tetraethyl lead.

Studies such as this may lead to more economical and effective means of controlling unrestrained combustion — such as "knock" in reciprocating engines. The work is typical of GM Research's effort to provide useful information for a moving America. And in this way continue to keep our promise of "More and better things for more people."

General Motors Research Laboratories

Warren, Michigan



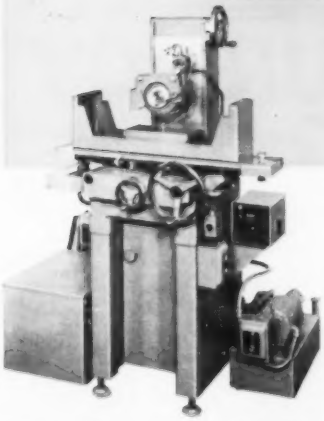
Iron carbonyl, an antiknock

Ethyl nitrate, a proknock

Iron carbonyl retards, ethyl nitrate accelerates central portion of cool flames.

FOR BETTER PRODUCTIVITY...

NEW GRINDER FITS JOB and OPERATOR



DoALL DH-612 SURFACE GRINDER
with hydraulic table drive (optional)

Table travel: 7 in. x 13 in.
Work height: 0 in. to 12½ in.
Saddle lock for form and plunge grinding.
Magnetic chucks, permanent and electric types with SELECTRON® rectifier.

Here is the newest modern, low-cost DoALL surface grinder. It can double on either your tool room work or production runs.

This outstanding grinder offers you the practical combination of both manual and hydraulic worktable movement. It provides convenience and versatility you'll find in no other grinder. Saddle ways support the entire work area. There's no table climb. Operators can grind directly from handwheel calibrations to "tenth" accuracy—with vertical feed calibrated to .0001 in. and cross-feed to .0005 in. Relying upon this accuracy of controls, operators eliminate the old grind-and-measure practice.

The operator can quickly "fit" this grinder to himself. Machine height is adjustable. Table handwheel is easily moved from left to right side of saddle and its position adjusted radially for greatest convenience. These are a few operating features that increase operator productivity.

Complete line of attachments, such as "Cool Grind" coolant system, hydraulic table control and many others, can be purchased with machine or added in your plant. Before you buy any surface grinder, see the model DH-612. Ask your DoALL Sales-Service Store to demonstrate.

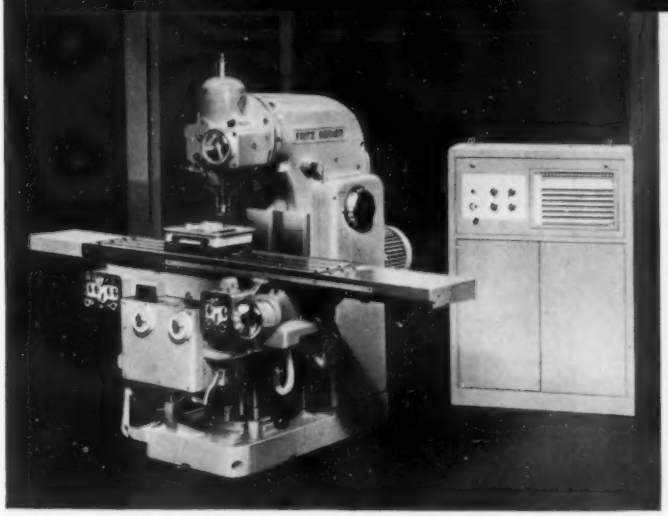
GR-29

THIS IS A
TYPICAL DoALL STORE

The DoALL Company, Des Plaines, Illinois

SLASH COSTS!

with WERNER PROGRAM-CONTROLLED Automatic 3-Dimensional Milling!



Now, combine WERNER Milling Machines* with the New WERNER pushbutton, Automatic Work Cycle Control Cabinet, and get a broader range of work positions, more flexibility, better accuracy and fewer rejects. WERNER Program-Controlled 3 Dimensional Milling gives you faster set-ups, less handling, of parts and safer control of speeds, feeds and movements.

*Adapt any new WERNER vertical or plain miller (Sizes 1 to 6).

What is Program-Controlled MILLING?

It's a Universal control system of automatically selecting work cycles by pushbutton control. The Electric Control Panel is simple in design and easy to operate. It controls all movements of the spindle, tools, speeds and feed changes. It eliminates undesirable variations encountered with conventional type milling machines.

Werner Program-Milling SAVES *You* MONEY *by:*

1 Permitting longitudinal, transverse and vertical motions to be arranged consecutively . . . in any sequence, and frequency on one milling machine.

2 Lowering time and labor in changeovers and re-tooling.

3 Assuring positive cycling and uniform work pieces.

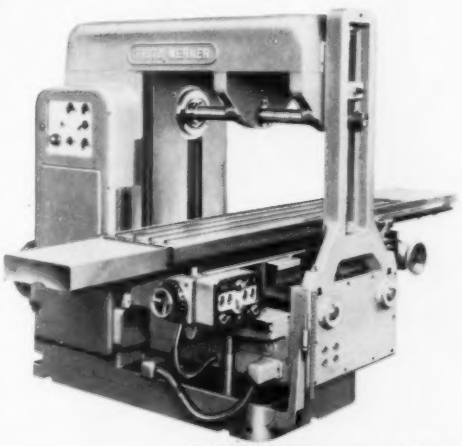
4 Milling pieces of various planes and dimensions in any direction, **in one loading.**

5 Minimizing loading inaccuracies.

6 Reducing inspection time, operator fatigue and errors.

7 Relieving skilled machinist operators for other duties.

8 Milling short runs, interchangeable tri-dog and pushbutton templates in minutes.

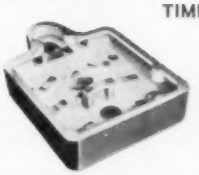


Model FV3D with Programming Control

TIME SAVED: 70%

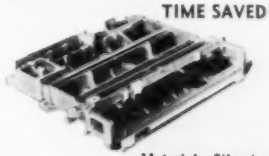
Material: Aluminum die-casting
Program-Milling: 3.4 min.
Previous method: 12 min.

TIME SAVED: 44%



Material: Silumin
Program-Milling: 11.2 min.
Previous Method: 23 min.

TIME SAVED: 72%



Material: Silumin
Program-Milling: 6.2 min.
Previous Method: 26 min.

VISIT OUR BOOTH '60 ASTE TOOL SHOW

SEE IT IN DETROIT

SEE Program-Controlled 3-Dimensional Milling demonstrated for the first time in U.S.A. BOOTH NO. 1919.

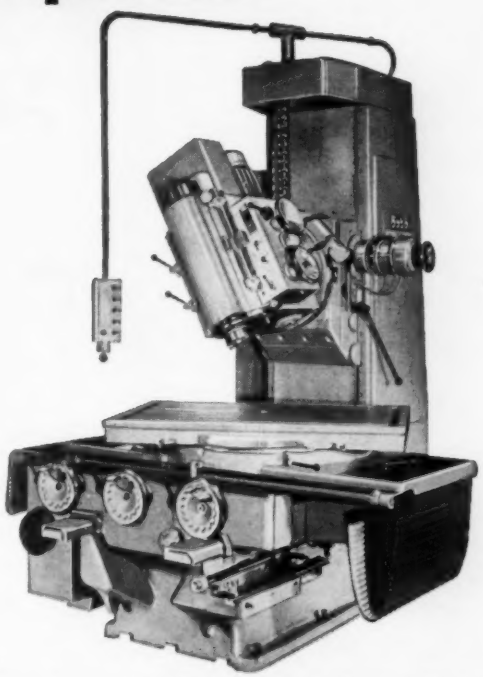
MARAC

MACHINERY CORPORATION

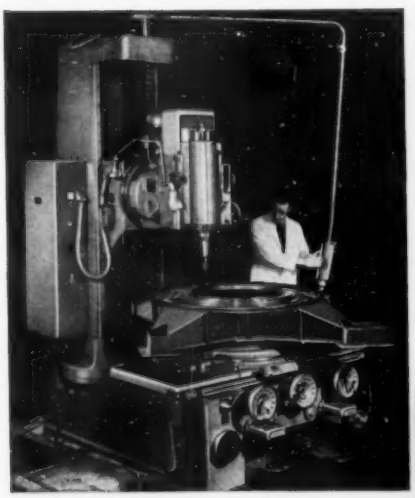
108 Grand St. • White Plains, New York

Avoid Double Handling of Large, Heavy Workpieces

with a BOKOE F3 Universal Miller

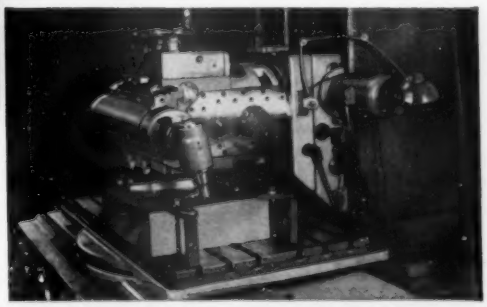


Save costly set-up time and avoid transferring bulky workpieces from one machine to another —with the BOKOE F3 Universal Milling and Boring Machine. On one, versatile machine you can now perform boring, milling and drilling—often on 5 sides—without re-setting the workpiece. The remarkably flexible operation of the BOKOE F3 is especially suited for the machining of ferrous and non-ferrous castings, dies, molds, and metal and wooden patterns. Check these many BOKOE features for *your* production needs . . .



Rotary milling on large component.

- Coordinate positioning of rotary worktable with steplessly adjustable feeds for transverse, longitudinal and rotary movements—operating either individually or simultaneously. Rapid travel for all three directions.
- Clamping area up to 63″ x 31.5″. Longitudinal movement up to 72″, transverse movement up to 28″. Maximum workpiece diameter for circular and radius milling, up to 98″. Maximum distance, main spindle to column, 48″.
- Stepless spindle speeds from 36—1800 rpm. Six spindle feeds from .0016 to .016 in./revolution. Spindle slide rotates 90° in either direction. Entire column rotates 360°.
- All electrical equipment in accordance with J.I.C. standards.



Head turned 90° with right-angle milling attachment.

Write For Information

COSA

Importers of Leading Precision Machine Tools
Nationwide Sales and Service
COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA—COSA CORPORATION OF CANADA LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario

Use Reader Service Card, CIRCLE 188

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 171.

Index of Advertisers

March 1960

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

***Exhibitor in 1958 ASTE Industrial Expositions**
♦Suppliers Directory Issue Advertiser

REGIONAL ADVERTISING OFFICES:

Austin G. Cragg, Director of Sales, 400 Madison Avenue, New York 17, N. Y., Telephone Plaza 9-4018
NEW YORK: Austin G. Cragg, Francis Baldwin, John Clarke, 400 Madison Avenue, New York 17, N. Y., Telephone: PLaza 9-4018
WEST HARTFORD: Donald N. McElwain, 2636 Albany Avenue, West Hartford, Conn., Telephone: ADams 3-5997
ATLANTA: Gus Krimsier; Cogill, Pirnie & Brown, 1722 Rhodes-Haverty Bldg., Telephone: JAckson 2-8113
CLEVELAND: George J. Zavis, 1367 E. Sixth Street, Lincoln Bldg., Room 200, Cleveland 15, Ohio, Telephone: TOwer 1-0330
CHICAGO: Stanley F. Girard, 612 N. Michigan Avenue, Chicago 11, Illinois, Telephone: MIchigan 2-4465
DETROIT: Alan Cobleigh, 10700 Puritan Avenue, Detroit 38, Michigan, Telephone: UNiversity 4-7300
LOS ANGELES: Robert E. Ahrensdorf, 3275 Wilshire Boulevard, Los Angeles 5, Calif., Telephone: DUnkirk 2-7337

LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Within the past few years a new concept of metalworking has been developed and applied—the direct use of electrical energy for the forming and machining of metals.

For example, electrical energy is used by Allied Research & Engineering Div. of Allied Record Manufacturing Co. to "electroform" parts by depositing metal on shaped mandrels. This process lends itself to reproduction of shapes and surface details that would be difficult or impossible to duplicate by other means.

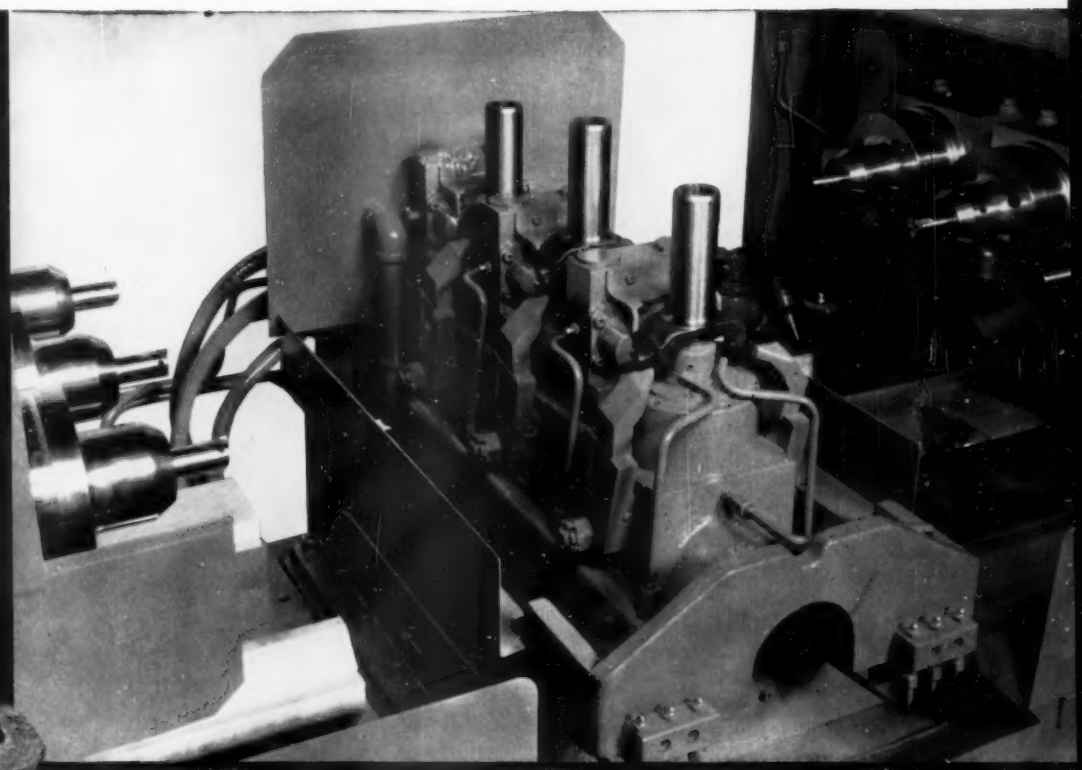
Use of plasma arcs for metalcutting and metal spraying—another direct application of electrical energy—is described in an article by James A. Browning that will appear in the April issue of this magazine. "Plasma" refers to a state of matter where atoms are torn apart to form electrons and ions. By constricting this arc as it emerges from a torch, calculated temperatures as high as 60,000 F are obtained, vaporizing even the hardest materials.

Holes as small as 0.0008 inch in diameter are being machined on a production basis with Zeiss electron beam machines to be manufactured in this country by Hamilton Standard Div. of United Aircraft Corp. Energy density during drilling runs as high as the equivalent of 600 million watts per square inch. Most of the energy used in machining is dissipated as vaporization of the material rather than into thermal heat. Beam efficiency is about 90 percent.

Another newly applied process, "hydrospark forming," is described in articles by J. Fred Parr, and by H. J. Wagner and J. G. Dunleavy in this issue. In this process, sometimes called "electrohydraulic forming," energy obtained by discharging an electric spark under water is used to shape sheet-metal parts. The process, a variation of explosive forming, has been put to work by Republic Aviation Corp.

Not so revolutionary, but equally significant to manufacturing efficiency, is the use of resistance-heated creep forming dies, as described by Richard Ludwig in this issue. In creep forming, dies are heated to 1200 F or higher, making it possible to form titantium aircraft parts without springback or buckling.

Resistance heating is also used in a new automatic welding machine developed by Arcos Corp. The machine welds heavy steel sections six times faster than automatic submerged arc equipment. The "electroslag" principle on which it operates takes advantage of the ability of molten slag to carry an electric current. Resistance of the slag to the current creates high heat.



RIGHT: Vertical splined arbors and clamps holding shoulders of bores are operated hydraulically.

BELOW: Universal yoke showing two holes bored simultaneously.

Two-Way Boring Speeds Parts Production

58-9

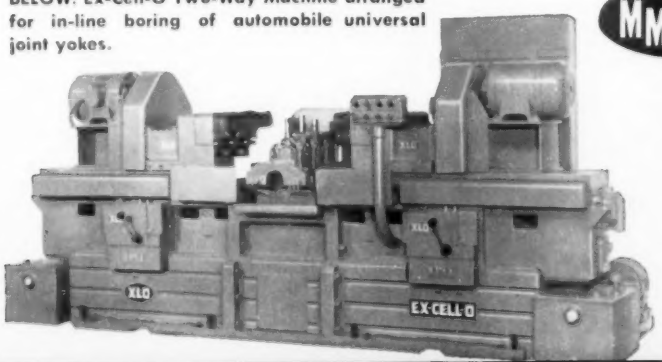
This Ex-Cell-O Precision Two-Way Boring Machine cuts production time of universal yokes for a manufacturer of automotive components by performing operations at both ends of a part—simultaneously.

Two independent machines interlocked electrically for central push-button control, the two-way unit bores two holes in line through malleable iron yokes held in a three station fixture. Both machine sections have three spindles on each slide for high production.

Two, three or four standard, self-contained way units can be easily arranged around a fixture at any angle the work requires. And like all Ex-Cell-O Precision Boring Machines, Way Machines are readily adaptable to different size workpieces—light, medium or heavy parts—and varying material requirements.

For complete information on versatile Ex-Cell-O Way Machines that can save time in your operation, contact your local Ex-Cell-O Representative, or write direct.

BELOW: Ex-Cell-O Two-Way Machine arranged for in-line boring of automobile universal joint yokes.



MMT-PE

XLO EX-CELL-O FOR PRECISION

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Above—5300 gallon capacity liquid oxygen storage tank fabricated by Graver Tank & Manufacturing Co., Inc. It consists of an outer vacuum shell of carbon steel plate and inner shell of stainless steel for service at –297° F.

How to make "Filling Station" tanks for Missiles

Graver flanges 11′ heads for liquid oxygen tanks in –Verson– flanging press

If you should ever want to make a tank for holding liquid oxygen, you'll find it takes a lot of know-how plus the right kind of equipment.

Graver Tank & Manufacturing Co., Inc., Division Union Tank Car Company, is a century old fabricator who knows the importance of good equipment. The Verson 375 ton hydraulic flanging press shown above is a good example.

Installed at Graver's East Chicago, Indiana, plant, it is shown flanging the 11′ diameter $\frac{3}{8}$" ASME carbon steel heads for the outer shell of liquid oxygen storage tanks. Stainless steel heads for an inner shell are also fabricated in the press. The press has two vertical rams and one horizontal ram, each of 125 tons capacity plus a bed cylinder of 125 tons capacity. All are individually controlled.

Even though liquid oxygen tanks are not your line, you should take advantage of Verson's experience for all your metal forming requirements. Verson's experience is broad and intensive, your best assurance of getting the kind of help you need. For specific recommendations, send an outline of your requirements.

Originators and pioneers of allsteel stamping press construction

VERSON ALLSTEEL PRESS CO.

Verson

231-C

9314 S. Kenwood Avenue, Chicago 19, Illinois • 8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES

TRANSMAT PRESSES • IMPACT MACHINING PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES • HYDRAULIC SHEARS

AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT